

**FINAL**

**No Further Remedial Action Planned  
Decision Document  
Site OT45**



**Wurtsmith Air Force Base  
Michigan**

**Prepared For**

**Air Force Center for Environmental Excellence  
Technology Transfer Division  
Brooks Air Force Base  
San Antonio, Texas**

**and**

**Wurtsmith Air Force Base  
Michigan**

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**February 1998**

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Michigan**

**February 1998**

**Prepared by**

**Parsons Engineering Science, Inc.  
1700 Broadway, Suite 900  
Denver, CO 80290**

# TECHNICAL DOCUMENT TO SUPPORT NO FURTHER ACTION DECLARATION

## SITE NAME AND LOCATION

Installation Restoration Program Site OT45  
Defense Reutilization and Marketing Office  
Wurtsmith Air Force Base  
Oscoda, Michigan

## STATEMENT OF PURPOSE AND BASIS

The purpose of this No Further Remedial Action Planned Decision Document (DD) is to recommend a preferred alternative for remedial action at Site OT45. This recommendation is based on the results of the Installation Restoration Program (IRP) remedial investigation (RI) conducted in 1992 and additional site investigation and sampling conducted between 1994 and 1997.

## DESCRIPTION OF THE SELECTED REMEDY

Based on current conditions at Site OT45 on Wurtsmith AFB, it has been determined that existing site conditions do not pose unacceptable risks to human health and the environment. This site documentation recommends no further action because natural chemical attenuation mechanisms have reduced contaminant concentrations in affected media (i.e., soils and groundwater) to levels below Michigan Department of Environmental Quality (MDEQ) commercial/industrial cleanup criteria.

## DECLARATION

This Decision Document represents the recommended and selected remedial action for site redevelopment in accordance with Michigan Public Act 451, Part 201. It has been determined that natural attenuation mechanisms have eliminated the risks associated with potential receptor exposure to site-related chemical contamination by reducing contaminant concentrations to levels below those considered to be protective of human health and the environment. The selected remedy will meet Federal and State requirements that are applicable, or relevant and appropriate.

\_\_\_\_\_  
*Paul Rekowski, U.S. Air Force Operating Location-T,  
Environmental Coordinator*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*Diana Mally, USEPA BCT Member*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*State of Michigan, BCT Member*

\_\_\_\_\_  
*Date*

# REPORT DOCUMENTATION PAGE

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## **DECISION DOCUMENT DISCLAIMER**

This Decision Document has been prepared for the United States Air Force by Parsons Engineering Science, Incorporated for the purpose of implementing a no further remedial action plan under the Air Force Installation Restoration Program (IRP). The objective of this Decision Document is to close Site OT45 and remove the site from the IRP. This decision is based on investigations performed at the site and the investigation results. Copies of this report may be requested from the Air Force Center for Environmental Excellence (AFCEE/ERT) Brooks AFB, TX 78235.

## EXECUTIVE SUMMARY

A comprehensive site investigation addressing soils and groundwater contaminated with heating fuel oil hydrocarbon compounds at Installation Restoration Program Site OT45, was conducted at Wurtsmith Air Force Base (AFB), Michigan, by Parsons Engineering Science, Inc. (Parsons ES). The field work was conducted according to the *Final Work Plan for a Remedial Action Plan in Support of the Risk-Based Approach to Remediation at Site* (Parsons ES 1994a). The risk-based demonstration for remediation of Site OT45 is sponsored by the United States (US) Air Force Center for Environmental Excellence (AFCEE) at Brooks AFB, Texas under contract F41624-93-C-8044.

The original intent of the work plan was to complete a remedial action plan (RAP) in support of a risk-based remediation decision for Site OT45. However, due to relatively low contaminant concentrations found in soil and groundwater samples, a decision was made to continue monitoring the site for several years to determine if contaminant levels would naturally decrease. Subsequent soil sampling in 1996 and groundwater sampling in 1996 and 1997 confirm that contaminant levels are now below generic commercial / industrial cleanup criteria. In view of this information a decision was made to present relevant site data in this No Further Remedial Action Planned Decision Document (DD) and apply for site closure.

Previous site investigations include a remedial investigation and feasibility study conducted by ICF in 1992 and 1993, respectively. Initial characterization field efforts for the Parsons ES risk-based investigation were conducted in September and October 1994. Groundwater monitoring data were collected in September 1995, November 1996, and June 1997 to verify the natural biodegradation of site contaminants. Additional soil sampling was completed in July/August 1996. Data presented in this DD focus on the results from 1996 and 1997 soil and groundwater sampling which show the site meets generic commercial/industrial cleanup criteria.

Wurtsmith AFB was officially closed as a military facility on June 30, 1993. Site OT45 is located in the northern portion of the former Base adjacent to Building 5608, within the confines of the former Defense Reutilization and Marketing Office (DRMO) storage facility. The site is located within a remote area of the Base, and consists of four storage buildings, an abandoned office building, and covered and uncovered staging areas. A former underground storage tank (UST) located on the northern side of Building 5608 is suspected of having leaked heating fuel oil when it failed tank integrity testing in the fall of 1991. The tank was purged in October 1991, and it remained empty until its removal in May 1992 (ICF Technology, Inc., 1993).

It is the intent of the Air Force to demonstrate in this DD attainment of MDEQ (1995b) nonsite-specific, land use-based (i.e., generic) industrial and commercial subcategory IV cleanup criteria at Site OT45. The activities conducted to meet this objective include characterizing:

- The nature and extent of fuel hydrocarbon contamination at the site;

- The local geology, hydrogeology, and hydrology that may affect contaminant transport;
- The proximity of the site to drinking water aquifers, surface water bodies, and other sensitive environmental resources, and;
- Comparing soil and groundwater sampling results to generic residential and commercial/industrial cleanup criteria

The current and foreseeable land use scenarios at Site OT45 are both industrial and commercial. The site is currently abandoned, except for occasional environmental restoration personnel. The current land use thus can be classified as industrial in nature. The reuse plan for Wurtsmith AFB designates the land at Site OT45 to be used for convention/tourist services (US Air Force, 1993). Any construction activities undertaken pursuant to future land use scenarios will be industrial or commercial in nature. The nature of planned activities at the potential convention/tourist facility are representative of the types of activities outlined by MDEQ (1995b) for commercial subcategory IV sites. Consequently, the current and future land use at Site OT45 will be first industrial and, possibly, commercial in nature. Hypothetical current receptors include non-intrusive and intrusive industrial workers. Hypothetical future onsite receptors could include visitors to the planned convention center and any office personnel.

The 1996 compliance soil sampling effort included collecting several soil samples to confirm that contaminants have been attenuated to a point where the concentrations are below generic soil leaching criteria. This 1996 sampling event indicated that no concentrations of site contaminants in soil currently exceed the most stringent of the MDEQ (1995a) generic residential criteria.

Concentrations of dissolved fuel-related contaminants in the groundwater underlying Site OT45 have been observed to decrease via naturally occurring chemical attenuation mechanisms, and have remained at concentrations that are protective of current and future onsite receptors. Historical data collected from 1992 through 1997 confirm reductions in contaminant concentrations and minimal forward migration in groundwater. Based on 1996 and 1997 sampling, the site groundwater meets MDEQ (1995a) generic residential cleanup criteria for groundwater except for one compound in one well. The one exception is the level of 1,2,4-Trimethylbenzene in MW-2, which exceeds residential criteria but is below commercial / industrial cleanup criteria. Verification soil sampling indicates that soil contaminants are not present at concentrations sufficient to impact groundwater and elevate onsite dissolved contaminant concentrations to levels that exceed MDEQ (1995b) generic commercial / industrial groundwater cleanup criteria.

In summary, site analytical data indicate that soils meet the most restrictive (residential) generic cleanup criteria and groundwater also meets residential criteria except for one compound in one monitoring well. Because of this single elevated result, site closure under commercial/industrial criteria is proposed. This DD proposes that no additional remediation is necessary to achieve appropriate generic cleanup criteria and to protect onsite and offsite receptors, and that the site may be eligible for closure with land use restricted to commercial/industrial uses.

# TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY .....	ES-1
SECTION 1 - INTRODUCTION.....	1-1
1.1 Purpose and Scope .....	1-1
1.2 Report Organization.....	1-1
1.3 Site Background .....	1-2
1.3.1 Location and Description .....	1-2
1.3.2 Previous Remedial Investigations.....	1-2
1.3.2.1 1994 Risk-Based Investigation Activities .....	1-2
1.3.2.2 1995 Groundwater Monitoring Activities .....	1-6
1.3.2.3 1996/1997 Groundwater Monitoring Activities .....	1-6
1.3.2.4 1996 Soil Sampling Activities .....	1-7
1.3.2.5 Summary of Sampling Methodology .....	1-7
SECTION 2 - PHYSICAL SETTING .....	2-1
2.1 Regional Topography and Surface Water Hydrogeology.....	2-1
2.2 Regional Geology and Hydrogeology.....	2-3
2.2.1 Geology .....	2-3
2.2.2 Hydrogeology .....	2-3
2.3 Site Topography and Surface Water Hydrology .....	2-5
2.4 Site Geology and Hydrogeology .....	2-5
2.4.1 Lithology and Stratigraphic Relationships .....	2-5
2.4.2 Site Hydrogeology .....	2-8
2.5 Climate Characteristics .....	2-8
2.6 Land Use.....	2-8
2.6.1 Site Access.....	2-8
2.6.2 Current Land Use .....	2-10
2.6.3 Proposed Land Use .....	2-10
2.7 Groundwater Use.....	2-11
SECTION 3 - SOIL AND GROUNDWATER SAMPLING .....	3-1
3.1 Overview.....	3-1
3.2 Sources of Contamination.....	3-1
3.3 Soil Gas Sampling Results .....	3-1
3.4 Soil Chemistry .....	3-2
3.4.1 1996 Sampling Event .....	3-2
3.5 Groundwater Chemistry .....	3-2
3.5.1 1992-1994 Sampling Event .....	3-7
3.5.2 1995 Sampling Event .....	3-7
3.5.3 1996/1997 Sampling Event.....	3-7



## TABLE OF CONTENTS (Continued)

	Page
SECTION 4 - EXPOSURE ASSESSMENT .....	4-1
SECTION 5 - SUMMARY .....	5-1
SECTION 6 - DESCRIPTION OF THE NFRAP ALTERNATIVE .....	6-1
6.1 Recommendation for Closure .....	6-1
REFERENCES .....	R-1

### APPENDICES

- A Boring Logs, Well Construction Diagrams and Well Development Data
- B Analytical Data

### LIST OF TABLES

No.	Title	Page
1.1	Analyte Reporting Limits .....	1-8
1.2	Site OT45 Analysis Summary .....	1-10
3.1	Soil Concentrations of Chemicals of Potential Concern .....	3-4
3.2	Dissolved Concentrations of Contaminants of Interest.....	3-7
4.1	Comparison of Soil Results to Cleanup Criteria .....	4-2
4.2	Comparison of Groundwater Results to Cleanup Criteria.....	4-3

### LIST OF FIGURES

No.	Title	Page
1.1	Regional Map .....	1-3
1.2	Location of Site OT45 Within Wurtsmith AFB .....	1-4
1.3	Site Map .....	1-5
2.1	Regional Topographic Map and Surface Water Features.....	2-2
2.2	Regional Geologic Cross Section A-A' .....	2-4
2.3	Location Map of Hydrogeologic Cross-Section B'B' .....	2-6
2.4	Hydrogeologic Cross Section B-B' .....	2-7
2.5	Groundwater Surface Elevation Map .....	2-9
3.1	Soil Gas Sampling Locations .....	3-3
3.2	Confirmation Soil Sampling Concentrations (1996) .....	3-6

## SECTION 1

### INTRODUCTION

#### 1.1 PURPOSE AND SCOPE

Parsons Engineering Science, Inc. (Parsons ES) was retained by the United States (US) Air Force Center for Environmental Excellence (AFCEE) to complete a risk-based site closure demonstration at Site OT45 at Wurtsmith Air Force Base (AFB), Michigan. This work is culminating with the preparation of a No Further Remedial Action Planned Decision Document (DD) for soil and groundwater contaminated with heating fuel oil hydrocarbons for the site. The Base was formally closed as a military facility on June 30, 1993. A historical release from a former underground storage tank (UST) at a former Defense Reutilization and Marketing Office (DRMO) located near the northern boundary of Wurtsmith AFB is suspected as having contaminated the surrounding subsurface with heating fuel oil hydrocarbons. The UST had been used to store heating fuel oil to support the heating requirements of the DRMO.

This DD demonstrates that site-related contaminant concentrations at IRP Site OT45 meet generic health-based residential cleanup criteria (MDEQ, 1995b) at all monitoring locations except for one. At MW-11, the level of 1,2,4-Trimethylbenzene exceeds residential criteria, but does not exceed commercial / industrial criteria.

#### 1.2 REPORT ORGANIZATION

This DD consists of five sections, including this introduction, and six appendices. Site background, including operational history and a review of environmental site investigations conducted to date, are provided in the remainder of this section. Section 2 summarizes the topographic, geologic, hydrogeologic and climatic setting of the site. Section 3 includes results of soil gas, soil and groundwater sampling and section 4 contains a data summary and analysis. Section 5 includes a request for an MDEQ-approved conditional closure of Site OT45 under generic commercial / industrial cleanup standards. References are found in Section 7.

Appendix A contains boring logs, well construction diagrams, and well development data for activities completed in 1994. Appendix B contains seventeen tables of soil and groundwater analytical data, geochemical field data, quality control/data validation information and other laboratory results.

## **1.3 SITE BACKGROUND**

### **1.3.1 Location and Description**

Wurtsmith AFB is located approximately 2 miles west of Oscoda, Michigan, within Iosco County (Figure 1.1). The Base is bounded on the north by Van Etten Lake, on the south by the Au Sable River and the Huron National Forest, on the east and the southeast by the cities of Oscoda and Au Sable, respectively, and on the west by the Alpena State Forest. The Base is less than 1 mile west of the western shore of Lake Huron. Van Etten Lake is a manmade lake that is surrounded by recreational cottages and local residential communities. The cities of Oscoda and Au Sable have a combined population of about 11,000 people [ICF Technology, Inc. (ICF), 1993 and 1994]. Wurtsmith AFB was placed on the 1991 Department of Defense Base Closure and Realignment Commission's list for closure. The Base was officially closed on June 30, 1993.

Site OT45 is located in the northern portion of the Base (Figure 1.2), and is the site of a former 1,000-gallon heating fuel oil underground storage tank (UST). The UST was located adjacent to Building 5608 in the DRMO complex. After the heating oil UST failed a Tracer Tight™ tank test, it was purged in October 1991, and remained empty until removed in May 1992 (ICF, 1993).

### **1.3.2 Previous Remedial Investigations**

A series of remedial investigations were conducted prior to the confirmation soil and groundwater sampling events performed in 1996 and 1997 (Figure 1.3). Two groundwater monitoring wells (W-OT45 and E-OT45) were installed at the ends of the former UST location in 1992 when the UST was removed. Composite soil samples were collected during this effort, and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and polynuclear aromatic hydrocarbon (PAH) compounds. Analytical results are contained in reports issued by ICF in 1993 and 1994 (ICF, 1993 and 1994).

Site OT45 was also partially characterized during a 1992 remedial investigation (RI) and a 1993 draft feasibility study (FS) under the Air Force IRP by ICF (1993 and 1994). As part of the RI, seven soil boreholes were drilled to depths up to 13 feet (ft) below ground surface (bgs) and sampled for BTEX, PAHs, methyl butyl ether (MTBE), and lead. Site-related contaminants were detected only in soil samples collected from the interval immediately above the water table (smear zone) during the 1992 RI.

Three of the seven RI boreholes were completed as groundwater monitoring wells (MW-1, MW-2, and MW-3). Groundwater samples were collected from the five existing monitoring wells during the RI (ICF, 1993). All collected samples were analyzed for BTEX, MTBE, and PAHs.

#### **1.3.2.1 1994 Risk-Based Investigation Activities**

The investigation completed at Site OT45 under the initial 1994 risk-based remediation field test was conducted using the approach and methodologies presented

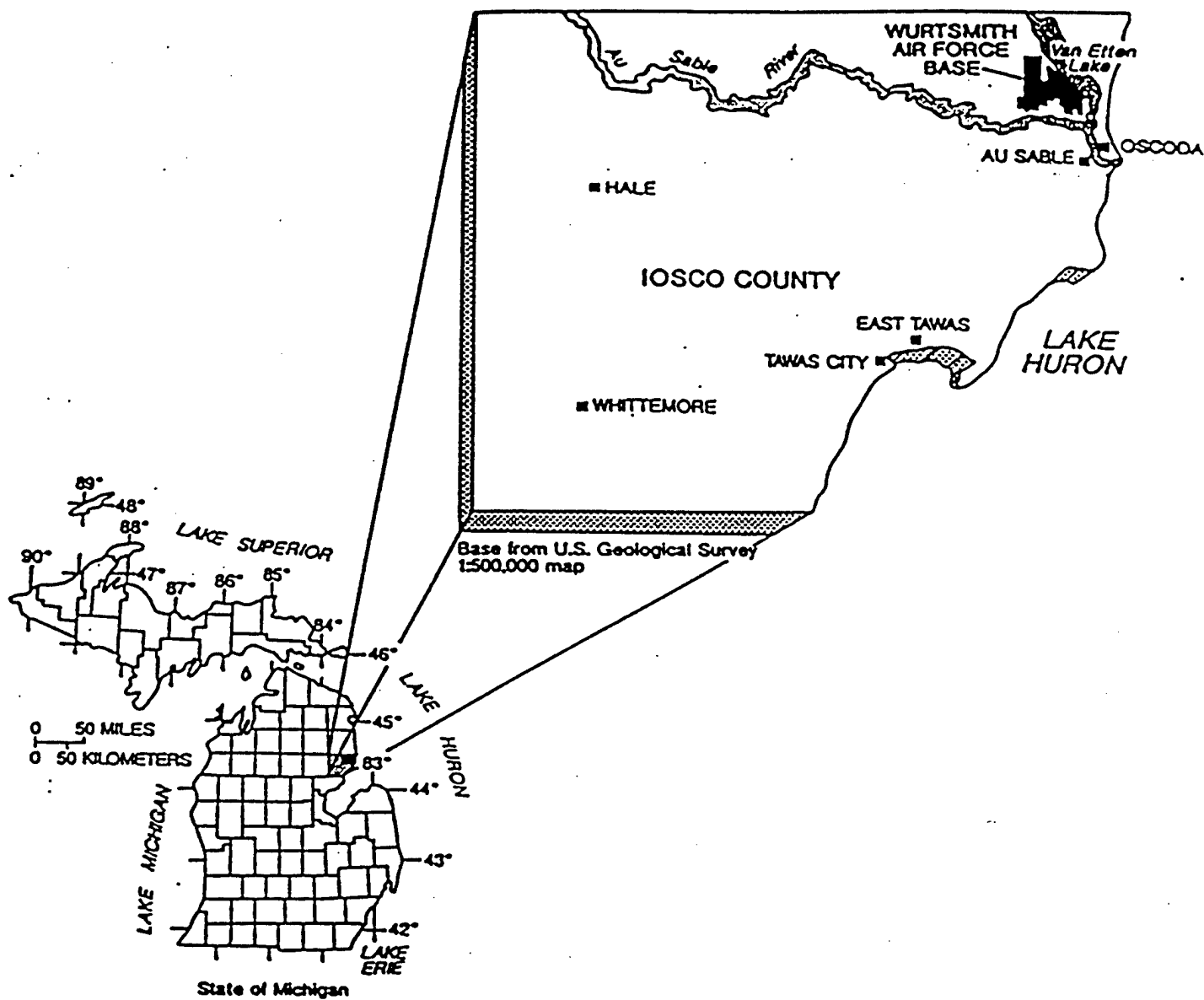


FIGURE 1.1

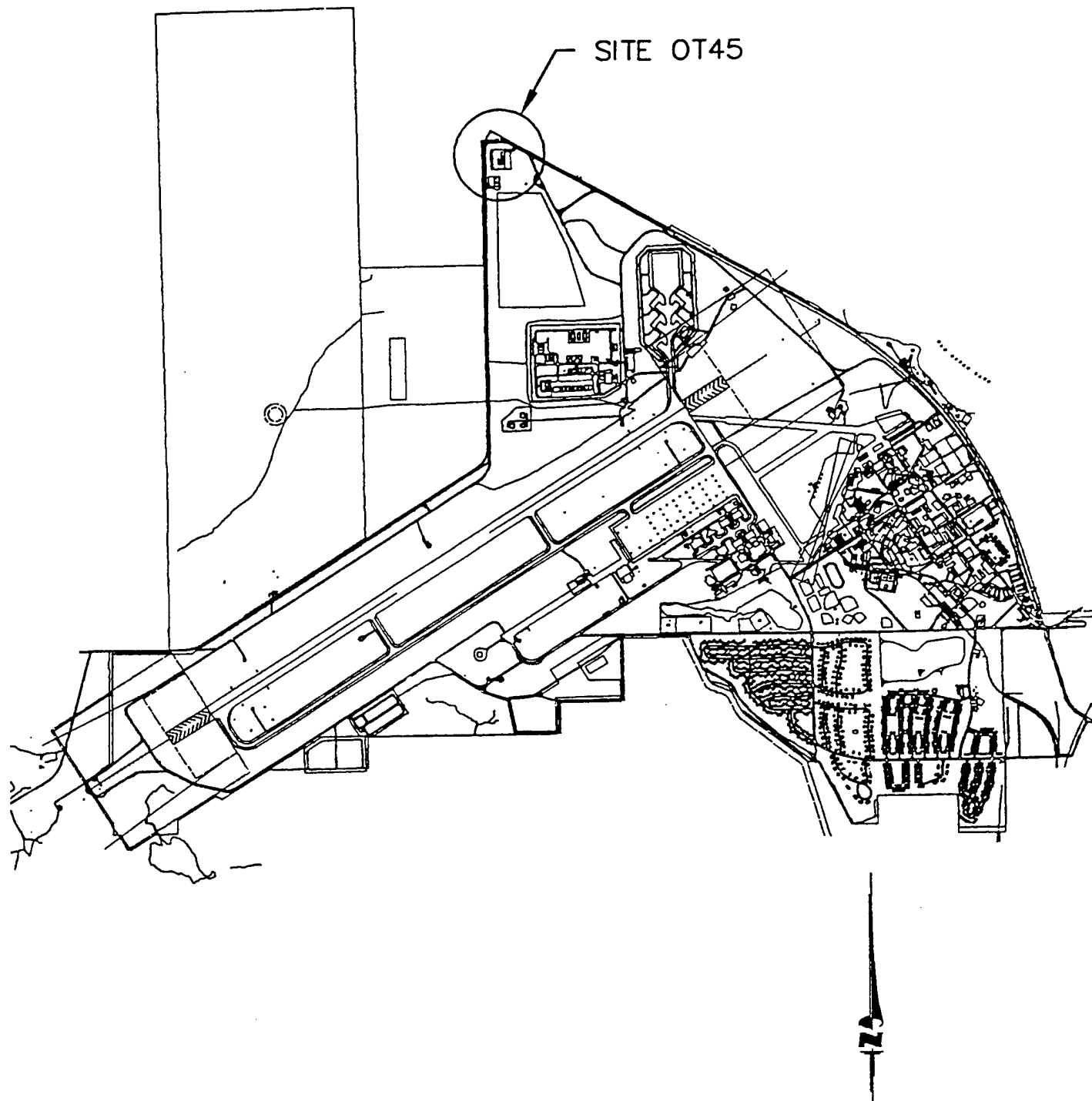
## REGIONAL MAP

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45  
Wurtsmith AFB, Michigan



**PARSONS  
ENGINEERING SCIENCE, INC.**

Denver, Colorado



Not to Scale

FIGURE 1.2

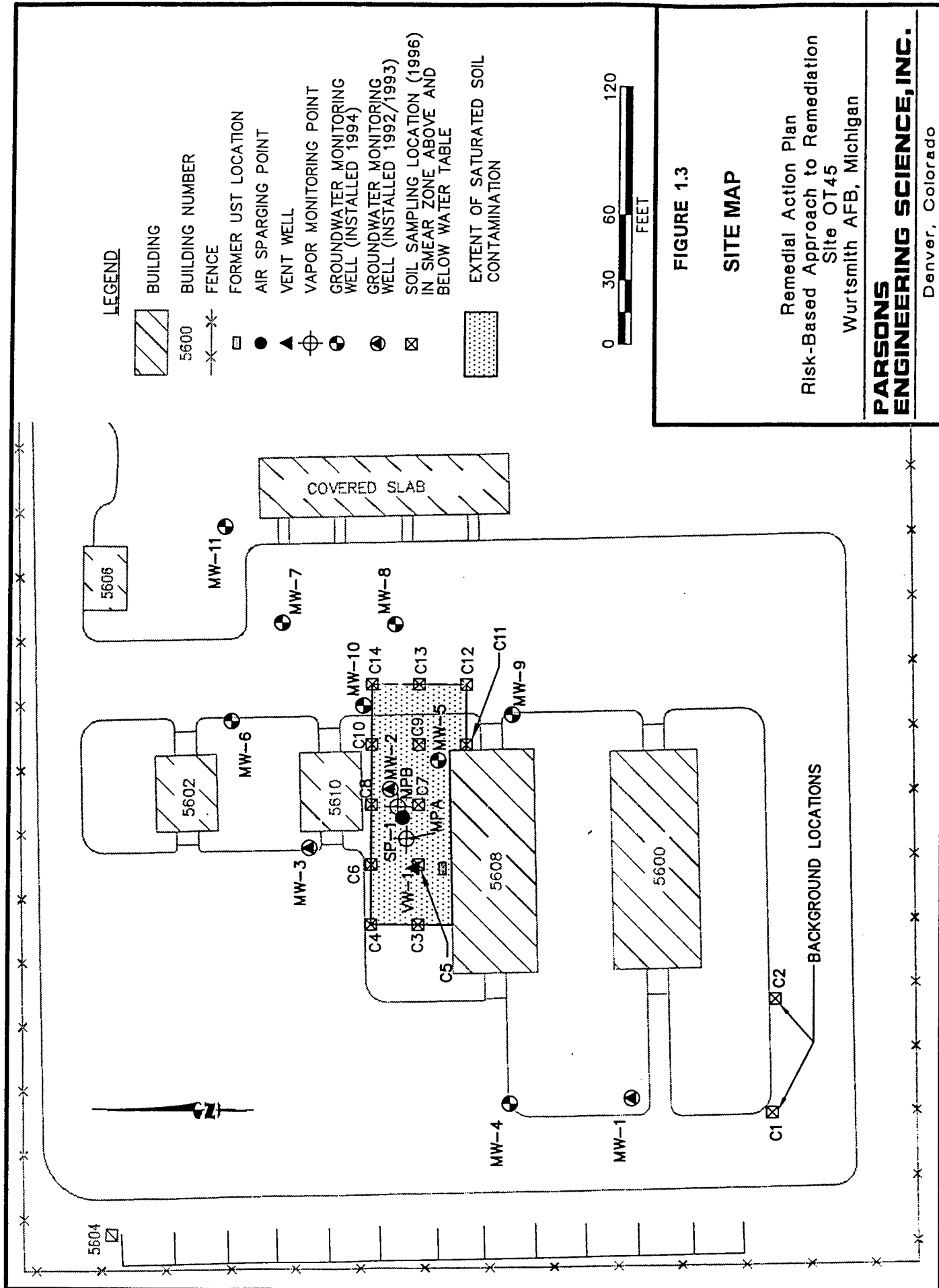
**LOCATION OF SITE OT45  
WITHIN WURTSMITH AFB**

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45  
Wurtsmith AFB, Michigan



**PARSONS  
ENGINEERING SCIENCE, INC.**

Denver, Colorado



in the *Work Plan for a Remedial Action Plan in Support of the Risk-Based Approach to Remediation at Site OT45* (Parsons ES, 1994a) (hereinafter referred to as the work plan). The following planned sampling and testing activities were performed by Parsons ES at Site OT45 as part of this field test:

- Collection of soil gas samples at 3 locations ;
- Collection of soil gas flux samples at 4 locations, including a background location;
- Drilling and installation of 8 permanent groundwater monitoring wells, 2 soil gas (vapor) monitoring points, 1 air injection bioventing test well, and 1 biosparging point;
- Collection of 3 surface soil and 14 discrete subsurface soil samples from 12 new soil boreholes for field screening and fixed-base analytical evaluation;
- Collection of 14 groundwater samples from different sampling locations for field and/or fixed-base analytical evaluation;
- Aquifer slug testing at 5 sampling locations, MW-4, MW-7, MW-10, MW-11, and MPA;
- Completion of an air permeability test and an oxygen influence test to assess the effectiveness of bioventing technology at stimulating natural biodegradation of heating oil hydrocarbons in unsaturated soil; and
- Completion of initial testing at the biosparging point to define optimum operational parameters in the event that a full-scale biosparging system is required to promote rapid natural biodegradation of heating oil hydrocarbons in saturated soils and shallow groundwater.

#### **1.3.2.2 1995 Groundwater Monitoring Activities**

In addition to the 1994 risk-based investigation, groundwater sampling was performed at select wells as part of a limited groundwater monitoring program sponsored by AFCEE to document reductions in concentration and extent of migration of site-related contamination over time. After evaluating the 1994 risk-based investigation results, seven groundwater monitoring wells and one monitoring point [MW-2, MW-4, MW-5, MW-7, MW-10, MW-11, MPB, and VW-1 (W-OT45)] were selected to monitor potential contaminant migration over time. Groundwater was collected from these sampling locations in September 1995 for fixed-based analytical analysis and field screening tests.

#### **1.3.2.3 1996/1997 Groundwater Monitoring Activities**

In an effort to verify predictions of reduction in the concentrations and migration of the site-related contamination over time, limited groundwater sampling was completed in November 1996 [MW-2 and MW-7], June 1997 [MW-2, MW-5, and VW-1], and

November 1997 [MW-2 and MW-11]. Groundwater was collected from these sampling locations for fixed-based analytical analysis.

#### **1.3.2.4 1996 Soil Sampling Activities**

In addition to the 1994 risk-based investigation, extensive soil sampling was performed as part of a confirmation sampling plan sponsored by AFCEE to document reductions in concentration and extent of site-related contamination over time. Soil sample locations were selected based on the results of the 1995 risk-based evaluation. Soil samples were collected from these sampling locations in July/August 1996 for fixed-based analytical analysis.

#### **1.3.2.5 Summary of Sampling Methodology**

A descriptive summary of all of the field and fixed-base analytical methods used at Site OT45 is presented in Table 1.1. All analytical methods and their program-specific method detection limits (MDLs) are identical to those recommended by MDEQ (1994b) in Operational Memorandum #6, Revision 3. Further details on analytical methods and data validation procedures are presented in Appendix B. Table 1.2 summarizes the field and fixed-base analytical methods used at each sampling location. Field sampling and testing activities are summarized briefly in the following sections.



TABLE 1.1  
ANALYTE REPORTING LIMITS  
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT  
SITE 0145, WURSMITH AFB, MICHIGAN

Compound	Analytical Method	Field or Fixed-Base	Soil Gas MDL	Soil Gas Units	Site-Specific Soil MDL	MDNR Soil Required MDL	Soil Reporting Limit	Soil Units	Site-Specific Water MDL	MDNR Water Required MDL	Water Reporting Limit	Water Units
Benzene	TO3	Fixed-Base	0.006	mg/L								
Toluene	TO3	Fixed-Base	0.008	mg/L								
Ethylbenzene	TO3	Fixed-Base	0.009	mg/L								
Xylene (Total)	TO3	Fixed-Base	0.009	mg/L								
Petroleum Hydrocarbons	TO3	Fixed-Base	0.130	mg/L								
Total Extractable Hydrocarbons	M8015	Fixed-Base										
Total Volatile Hydrocarbons	M8015	Fixed-Base			5.840		110,000	µg/kg	0.522		5,000	µg/L
									0.089		1,000	µg/L
Benzene	SW8020	Fixed-Base			0.400	10,000		µg/kg	0.283	1,000	0.400	µg/L
Toluene	SW8020	Fixed-Base			0.400	10,000		µg/kg	0.257	1,000	4,000	µg/L
Ethylbenzene	SW8020	Fixed-Base			0.400	10,000		µg/kg	0.283	1,000	4,000	µg/L
Xylene (Total)	SW8020	Fixed-Base			0.400	30,000		µg/kg	0.247	3,000	4,000	µg/L
1,2,3-Trimethylbenzene	SW8020	Fixed-Base			0.400			µg/kg	0.153	1,000	4,000	µg/L
1,2,4-Trimethylbenzene	SW8020	Fixed-Base			0.400	10,000		µg/kg	0.168		4,000	µg/L
1,3,5-Trimethylbenzene	SW8020	Fixed-Base			0.400			µg/kg	0.168		4,000	µg/L
2-Methylnaphthalene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.010	5,000	10,000	µg/L
Acenaphthene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.430	5,000	10,000	µg/L
Acenaphthylene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.270	5,000	10,000	µg/L
Anthracene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.320	5,000	10,000	µg/L
Benzo(a)anthracene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.350	5,000	10,000	µg/L
Benzo(b)pyrene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.370	5,000	10,000	µg/L
Benzo(k)fluoranthene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.440	5,000	10,000	µg/L
Benzo(g,h,i)perylene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.200	5,000	10,000	µg/L
Benzo(e)fluoranthene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.510	5,000	10,000	µg/L
Chrysene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.330	5,000	10,000	µg/L
Dibenz(a,h)anthracene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.680	5,000	10,000	µg/L
Dibenzofuran	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.010	5,000	10,000	µg/L
Fluoranthene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.410	5,000	10,000	µg/L
Fluorene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.420	5,000	10,000	µg/L
Indeno(1,2,3-cd)pyrene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.470	5,000	10,000	µg/L
Naphthalene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.380	5,000	10,000	µg/L
Phenanthrene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.190	5,000	10,000	µg/L

TABLE 1.1 (Continued)  
ANALYTE REPORTING LIMITS  
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT  
SITE 0T45, WURSMITH AFB, MICHIGAN

Compound	Analytical Method	Field or Fixed-Base	Soil Gas MDL	Soil Gas Units	Site-Specific Soil MDL	MDNR Soil Required MDL	Soil Reporting Limit	Soil Units	Site-Specific Water MDL	MDNR Water Required MDL	Water Reporting Limit	Water Units
Pyrene	SW8270	Fixed-Base			10,000	330,000	330,000	µg/kg	0.370	5,000	10,000	µg/L
pH	SW9045	Fixed-Base					0.010	pH Units				
Total Organic Carbon	SW9060	Fixed-Base			0.015		0.050	Percent				
Moisture, Percent	E160.3	Fixed-Base					0.100	Percent				
Phosphorus, Total Orthophosphate (as P)	E300.0	Fixed-Base			0.510		2,500	mg/kg				
Alkalinity, Total (as CaCO <sub>3</sub> )	E310.1	Fixed-Base					25,000	mg/kg				
Nitrogen, Total Kjeldahl	E351.3	Fixed-Base			5,000		5,000	mg/kg				
Iron	SW6010	Fixed-Base			0.032	2,000	1,600	mg/kg				
Benzene	SW8240	Fixed-Base							0.330	1,000	0.400	µg/L
Toluene	SW8240	Fixed-Base							0.380	1,000	5,000	µg/L
Ethylbenzene	SW8240	Fixed-Base							0.450	1,000	5,000	µg/L
Xylene (Total)	SW8240	Fixed-Base							0.220	3,000	5,000	µg/L
1,2,3-Trimethylbenzene	SW8240	Fixed-Base							0.200	1,000	5,000	µg/L
1,2,4-Trimethylbenzene	SW8240	Fixed-Base							0.200	5,000	5,000	µg/L
1,3,5-Trimethylbenzene	SW8240	Fixed-Base							0.200	5,000	5,000	µg/L
Benzene	SW8260	Fixed-Base							0.500	1,000	5,000	µg/L
Toluene	SW8260	Fixed-Base							0.500	1,000	5,000	µg/L
Ethylbenzene	SW8260	Fixed-Base							0.500	1,000	5,000	µg/L
Xylene (Total)	SW8260	Fixed-Base							0.500	3,000	5,000	µg/L
1,2,3-Trimethylbenzene	SW8260	Fixed-Base							0.500	1,000	5,000	µg/L
1,2,4-Trimethylbenzene	SW8260	Fixed-Base							0.500	5,000	5,000	µg/L
1,3,5-Trimethylbenzene	SW8260	Fixed-Base							0.500	5,000	5,000	µg/L
Electrical Conductivity	FCOND	Field									0.020	mmhos/cm
Dissolved Oxygen	FDO	Field									0.500	mg/L
pH	FPH	Field									0.000	pH Units
Redox Potential	FREDOX	Field									0.000	pE Units
Temperature	FTEMP	Field									1.000	° C
Iron	H8008	Field							0.010	0.100	0.024	mg/L
Nitrate	H8039	Field							0.010		0.066	mg/L
Nitrite	H8040	Field							0.005		0.010	mg/L
Sulfate	H8051	Field							0.010		0.010	mg/L
Hydrogen Sulfide	H8131	Field							0.010	0.200	0.024	mg/L
Iron, Ferrous	H8146	Field							0.010		0.024	mg/L
Alkalinity, Total (as CaCO <sub>3</sub> )	H8221	Field									20,000	mg/L
Carbon Dioxide	H8223	Field							0.010		1.250	mg/L
Manganese	HLMANG	Field							0.010	0.020	0.050	mg/L
Carbon Dioxide	COU-O2	Fixed-Base							4,000		5,000	mg/L
Methane	RSK175	Fixed-Base							0.004		0.004	mg/L

\* Source: MDNR (1994a) Interoffice Communication Memorandum #6, Revision 3, Analytical Detection Limit Guidance (dated February 4, 1994).

TABLE 1.2  
SITE OT45 ANALYSIS SUMMARY  
NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT  
SITE OT45, WURTSMITH AFB, MICHIGAN

SAMPLING LOCATION	NORTHING	EASTING	SAMPLE MATRIX	SAMPLE DEPTH (ft. bgs)	SCREENED ANALYTES AND FIELD PARAMETERS												SOIL pH	SOIL TOC	
					BTEX	PNA	TVH/TEH	ELECTRON ACCEPTORS	MOISTURE CONTENT	PHOS	ALK	CO2	CH4	NITROGEN	IRON				
BKG	--	--	Soil Gas Flux	NA	1 <sup>a</sup>														
NPA	423602.29	2246385.61	Soil	0-25		X													
MPB <sup>c</sup>	423606.49	2246400.48	Soil Gas	9-9.5	1					X						X			
			Soil Gas Flux	NA	1														
			Soil	0-25		X													
				8-9.5	2	X	X						X			X			
MW1	423496.87	2246264.70	Ground Water	NA	2	X		X											
MW2 <sup>c,d</sup>	423610.18	2246408.92	Ground Water	NA	2	X		X					X						
			Soil Gas	5-10	1														
			Soil Gas Flux	NA	1														
			Ground Water	NA	2	X		X											
			Drill Cuttings	12-15	2	X	X						X						
MW3	423647.43	2246381.06	Ground Water	NA	2	X		X											
MW4 <sup>e</sup>	423553.65	2246261.74	Ground Water	NA	2	X		X											
			Soil	8-9.5	2	X									X				
			Ground Water	NA	2			X										X	
MW5 <sup>e,f</sup>	423587.70	2246422.21	Ground Water	NA	2														
			Soil	10-13	2	X													
			Ground Water	NA	2	X		X											
MW6	423684.09	2246440.02	Ground Water	NA	2	X													
			Soil	8-9.5	2	X											X		
			Ground Water	NA	2	X		X											
MW7 <sup>e,d</sup>	423660.84	2246486.03	Ground Water	NA	2	X	X												
			Soil	8-9	2	X	X												
			Ground Water	NA	2	X	X							X	X			X	
MW8	423608.05	2246485.58	Ground Water	NA	2	X													
			Soil	8-9.5	2	X		X											
			Ground Water	NA	2	X													
MW9	423553.39	2246443.59	Ground Water	NA	2				X										
			Soil	68-70															
			Ground Water	NA	2														
MW10 <sup>e</sup>	423622.64	2246447.63	Ground Water	NA	2														
			Soil	9-11	2	X										X		X	
			Ground Water	NA	2	X		X											
			Soil	10-12	2	X													
			Ground Water	NA	2														
MW11 <sup>e</sup>	423687.81	2246530.32	Ground Water	NA	2 & 3 <sup>e</sup>												X		
			Soil Gas	5-10	1														
			Soil Gas Flux	NA	1														
			Soil	0-25		X													
			Ground Water	NA	2														
VW1 <sup>e,f</sup>	423598.95	2246371.88	Ground Water	NA	2														
			Soil	8-9.5	2	X										X			
			Ground Water	NA	2	X										X		X	
			Soil	0-25															
			Ground Water	NA	2														

<sup>a</sup> 1 = TO3: Determination of Volatile Organic Compounds in Ambient Air

<sup>b</sup> 2 = SW8020: Purgable Aromatics

<sup>c</sup> This well was sampled during both the 1994 and 1995 sampling events. Only groundwater samples were collected during the 1995 sampling event. Groundwater samples collected during the 1995 sampling event were analyzed for BTEX, PAHs, and electron acceptors.

<sup>d</sup> This well was sampled for purgable organics (SW8020) in 1996

<sup>e</sup> This well was sampled for purgable organics (SW8020) in 1997.

Note: Soil samples collected in 1996 were analyzed for purgable organics (SW8020) and PNAs (SW8270).

## SECTION 2

### PHYSICAL SETTING

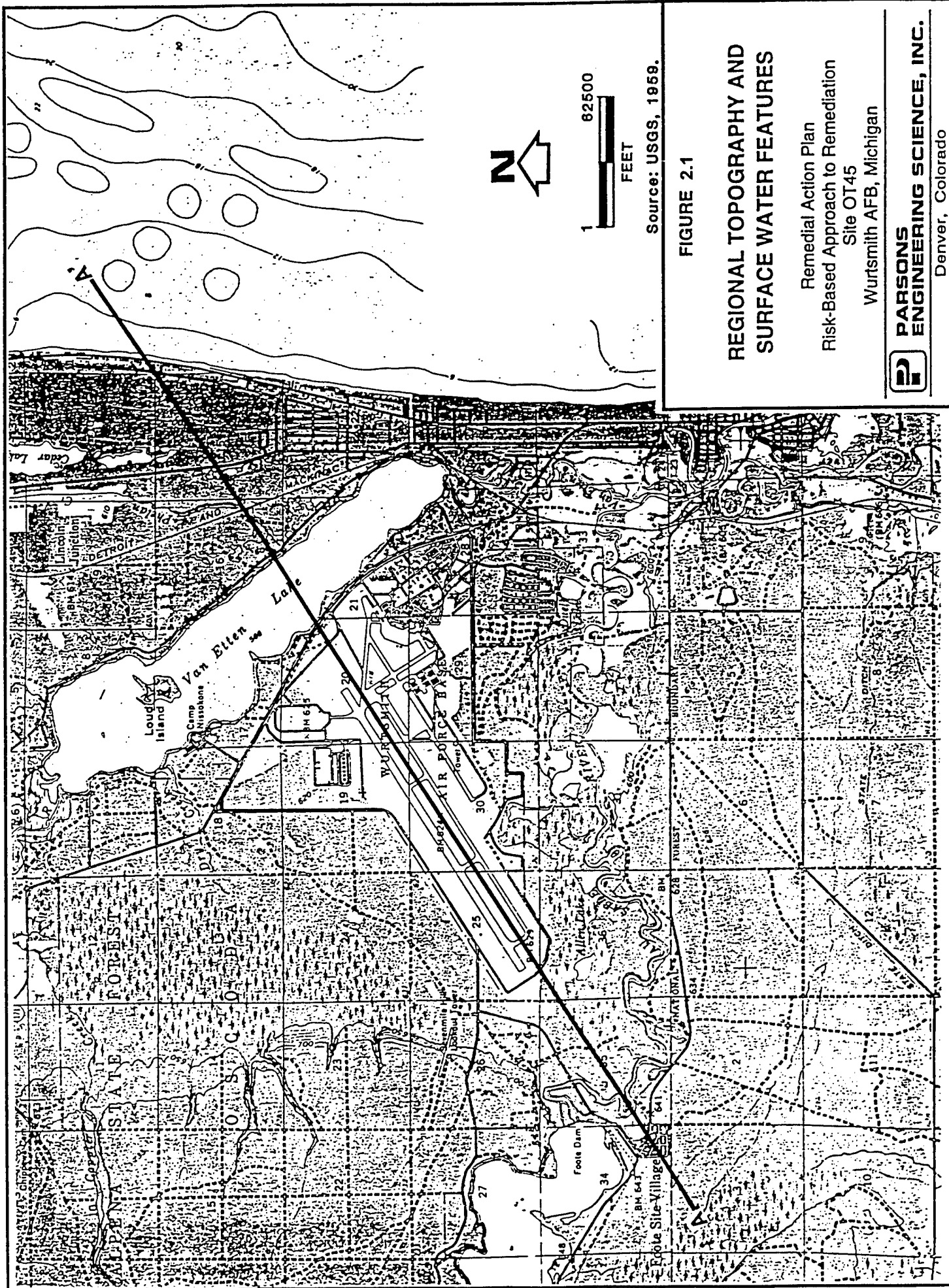
This section describes the physical characteristics of Site OT45 as determined from data collected during previous investigations conducted under the IRP and by Parsons ES as part of the 1994 risk-based investigation. Data incorporated into this section from previous investigations were taken from the RI (ICF, 1993) and the FS (ICF, 1994) reports for Site OT45. A summary of site characterization activities completed by Parsons ES to supplement existing data is presented in Section 2 of this DD.

#### 2.1 REGIONAL TOPOGRAPHY AND SURFACE WATER HYDROGEOLOGY

Wurtsmith AFB lies on the relatively flat Oscoda Lake plain physiographic district near the eastern shore of Michigan [US Geological Survey (USGS), 1990]. This plain extends approximately 5 miles from the shore of Lake Huron to 80-foot-high bluffs west of the Base. Elevations in this area range from approximately 580 feet above mean sea level (msl) at Lake Huron to 650 feet above msl near the base of the bluffs. The Base and surrounding area have relatively flat topography, with the northern portion of the Base, including Site OT45, sloping very gently to the northeast toward Van Etten Lake. Surface elevations in the vicinity of Site OT45 range from approximately 617 feet above msl at Site OT45 to 588 feet above msl at Van Etten Lake. The topography and major surface water features of the environs near Wurtsmith AFB are shown on Figure 2.1.

The main surface water bodies in the vicinity of Wurtsmith AFB are Dry Creek, Van Etten Lake, Lake Huron, and the Au Sable River. Dry Creek drains a swampy area located west of the Base and flows into Van Etten Lake. Van Etten Lake is fed by the Pine River from the north, and discharges into Van Etten Creek, located at the southeastern end of the lake. Van Etten Creek is a tributary to the Au Sable River, which drains a large area of Michigan west of the Base and discharges into Lake Huron.

There are no major surface water features on Wurtsmith AFB. Because the topography is relatively flat and the soils beneath the Base are sandy, most precipitation infiltrates into the groundwater system. Runoff from paved areas is collected via a storm sewer system, treated at the Wurtsmith AFB sewage treatment plant, and then discharged into settling ponds located near the southern Base boundary (ICF, 1994). Limited amounts of surface water runoff drain northeast into Van Etten Lake and south into the Au Sable River.



Source: USGS, 1959.

FIGURE 2.1

# REGIONAL TOPOGRAPHY AND SURFACE WATER FEATURES

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45  
Wurtsmith AFB, Michigan

## 2.2 REGIONAL GEOLOGY AND HYDROGEOLOGY

### 2.2.1 Geology

The regional geology consists of approximately 100 to more than 250 feet of unconsolidated glacial, deltaic, and lacustrine deposits overlying the Mississippian-aged Marshall Formation sandstone and Coldwater Shale bedrock (Rama Rao and Alfred, Inc., 1992). A generalized geologic cross section of the Base and adjacent area is presented in Figure 2.2. The location of the cross section A-A' is shown on Figure 2.1. The glacially eroded bedrock surface dips gently from west to east toward Lake Huron, and is overlain by unconsolidated Pleistocene and younger deposits. The unconsolidated deposits, progressing upward from the upper bedrock surface, consist of glacial till; lacustrine silt and clay; and beach, eolian, and alluvial sand and gravel deposits.

Glacial till, consisting of clay-rich silt, sand, and gravel, directly overlies the eroded bedrock surface. Above the glacial till is a continuous layer of silty clay lake sediments ranging in thickness from approximately 95 to more than 200 feet. This silty clay layer forms the lower confining layer for the regional, shallow sand and gravel aquifer. The shallowest deposits, extending from the surface to depths of approximately 30 to 80 feet bgs, consist of fine to very coarse sand with occasional gravelly layers. This interval of alluvial, beach, and eolian deposits forms the regional shallow groundwater aquifer, and is the interval of primary interest for this study.

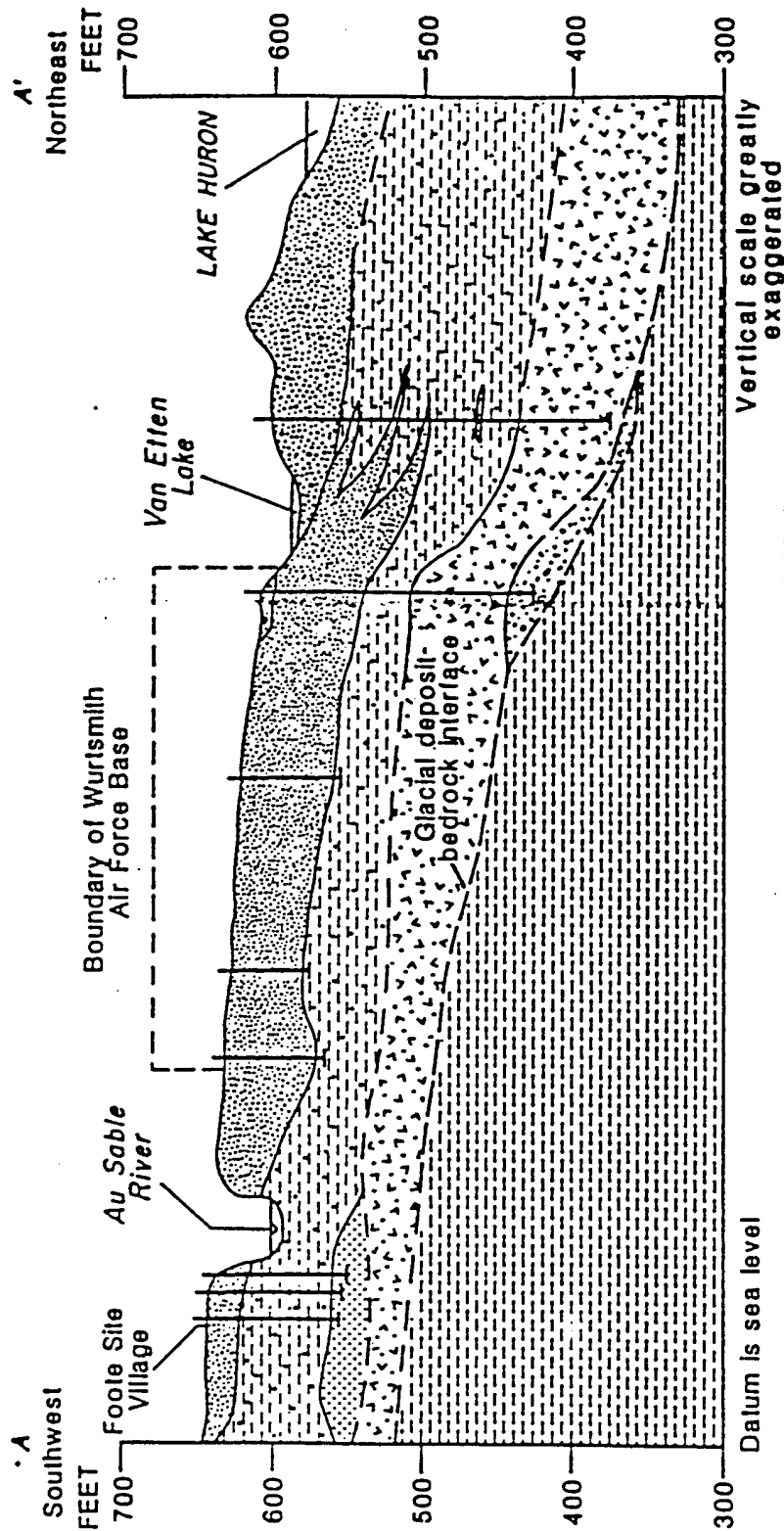
The Soil Conservation Service has identified the Grayling sand as the primary soil association at Wurtsmith AFB (ICF, 1993). The Grayling series consists of excessively drained soils formed in sandy glaciofluvial sediments, with slopes ranging from 0 to 6 percent.

### 2.2.2 Hydrogeology

Groundwater occurs predominantly in two aquifers, the shallow sands and deeper glacial deposits, separated by the intervening lacustrine clay and silt layer. The clay and silt layer forms an aquitard between the two water-bearing zones and retards downward migration of contaminant plumes (ICF, 1994).

The surficial sand and gravel deposits comprise the principal aquifer in the vicinity of Wurtsmith AFB. Groundwater occurs at depths ranging from less than 10 feet bgs at places in the western part of the Base, to 25 feet bgs near Van Etten Lake. Groundwater levels fluctuate 1 to 3 feet annually. The shallow aquifer is under unconfined water table conditions. Most groundwater beneath Wurtsmith AFB flows to the northeast, toward Van Etten Lake, and a smaller portion, beneath the southern portion of the Base, flows to the south toward the Au Sable River.

Studies performed by the USGS (1990) in 1979-81 and 1982-85 indicated that average groundwater velocities range from 0.8 foot per day (ft/day) in the eastern part of the Base to 0.3 ft/day in the western part. However, results of the 1982-85 study indicated velocities as high as 5 ft/day at some locations.



- EXPLANATION**
- DESCRIPTION OF UNITS**
- Alluvial deposits
  - Beach and eolian sand deposits
  - Deltic sand deposits
  - Lacustrine silt and clay
  - Sand and gravel
  - Till
  - Marshall Formation
  - Coldwater Shale
  - WELL

FIGURE 2.2

## REGIONAL GEOLOGIC CROSS SECTION A-A'

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45  
Wurtsmith AFB, Michigan



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## **2.3 SITE TOPOGRAPHY AND SURFACE WATER HYDROLOGY**

Site OT45 and the surrounding area is generally flat, with a surface elevation of approximately 620 feet above msl. Surface features at the site include grass and wooded areas; concrete, asphalt, crushed rock, and steel mesh driveways and parking areas; an office building; and several storage buildings. The northern part of the Base, including Site OT45, slopes very gently to the northeast toward Van Etten Lake, with an average slope of approximately 0.003 foot per foot (ft/ft).

Because of the flat topography and well-drained, sandy soils, most precipitation infiltrates the sandy soils, and as a result, there are no well-developed surface drainage features. There are no bodies of surface water in the immediate vicinity of Site OT45. The bodies of surface water closest to the site are Dry Creek (1,400 feet north) and Van Etten Lake (3,000 feet northeast).

## **2.4 SITE GEOLOGY AND HYDROGEOLOGY**

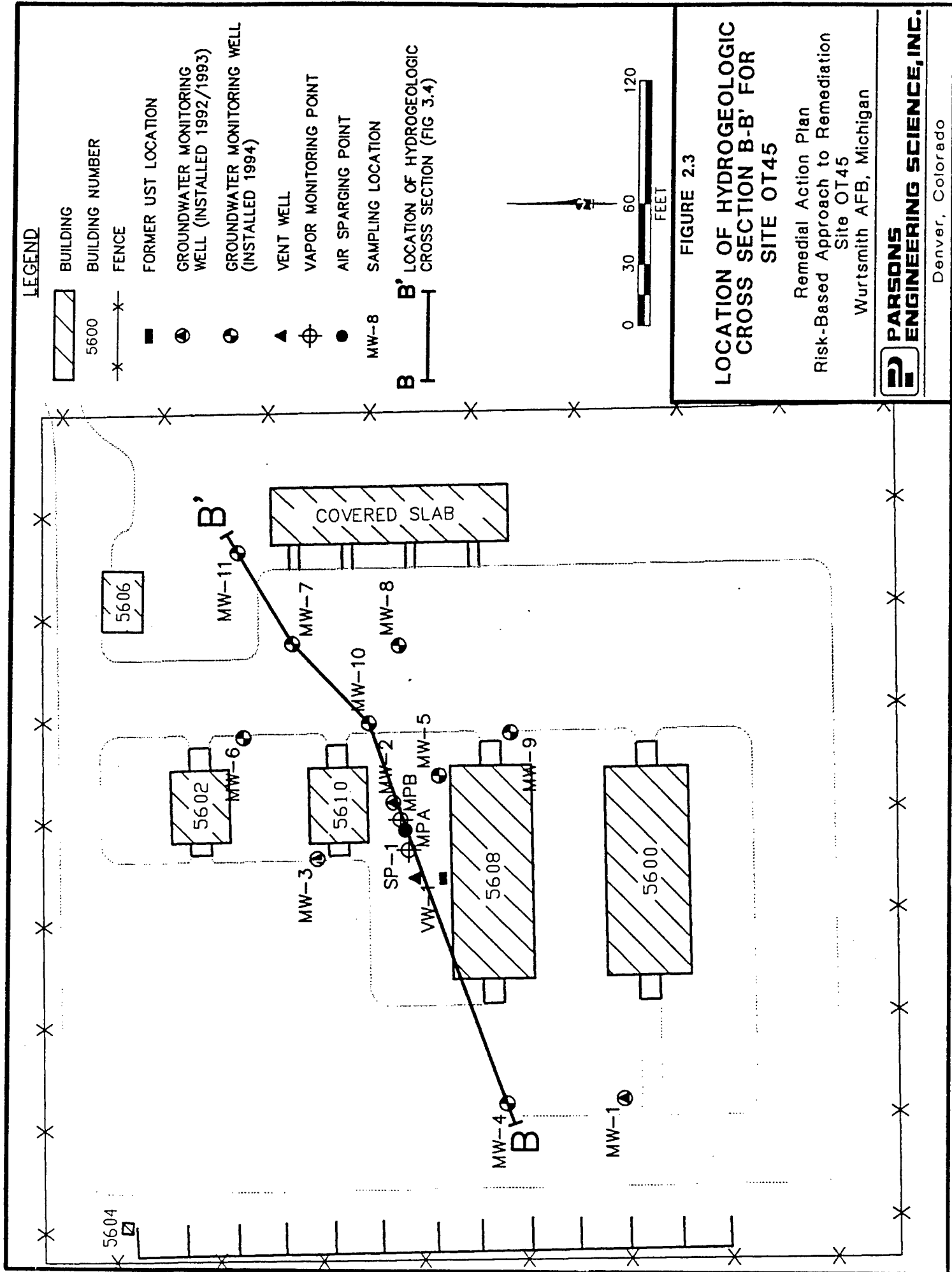
The vadose zone and shallow aquifer system at Site OT45 were characterized by Parsons ES as part of the initial risk-based investigation during September and October 1994. Data collected as part of this field test were used to supplement geologic and hydrogeologic data collected under the IRP by ICF (1993).

### **2.4.1 Lithology and Stratigraphic Relationships**

Drilling and soil sampling results show that the deposits from the surface to a depth of approximately 70 feet bgs consist predominantly of medium- to very coarse-grained sand overlying slightly silty clay. Figure 2.3 shows the location of cross section B-B' (Figure 2.4), oriented through the center of the source area and parallel to the direction of groundwater flow. The sand deposits are the Pleistocene and younger beach, eolian, and alluvial deposits previously discussed. The sand deposits are poorly to moderately sorted and generally increase in grain size with depth. Occasional gravelly layers were encountered within the sand, with the highest percentage of gravel occurring just above the underlying silty clay layer. A few, thin (generally less than 1 inch thick) silt and silty clay layers were encountered in the upper 20 feet of the sand. One laterally extensive silty clay layer (less than 2 inches thick) was encountered in most soil boreholes at or just below the top of the saturated zone. The sand is a light to medium, yellow- or orange-brown color with iron staining in the upper 10 to 15 feet. In the source area, fuel contamination and biological activity have stained the sand a medium gray to gray-brown.

A clay layer was encountered at depths of between 66 and 70 feet bgs in three soil boreholes (MW-2, MW-3, and MW-10). This clay appears to be the top of the regionally continuous lacustrine clay layer that overlies the glacial till. No soil boreholes were drilled deeper than the top of the clay layer at a depth of 70 feet bgs. The clay layer is a gray, very stiff to hard, silty clay. The hard texture and high clay content of the clay layer indicates very low permeability to groundwater flow.





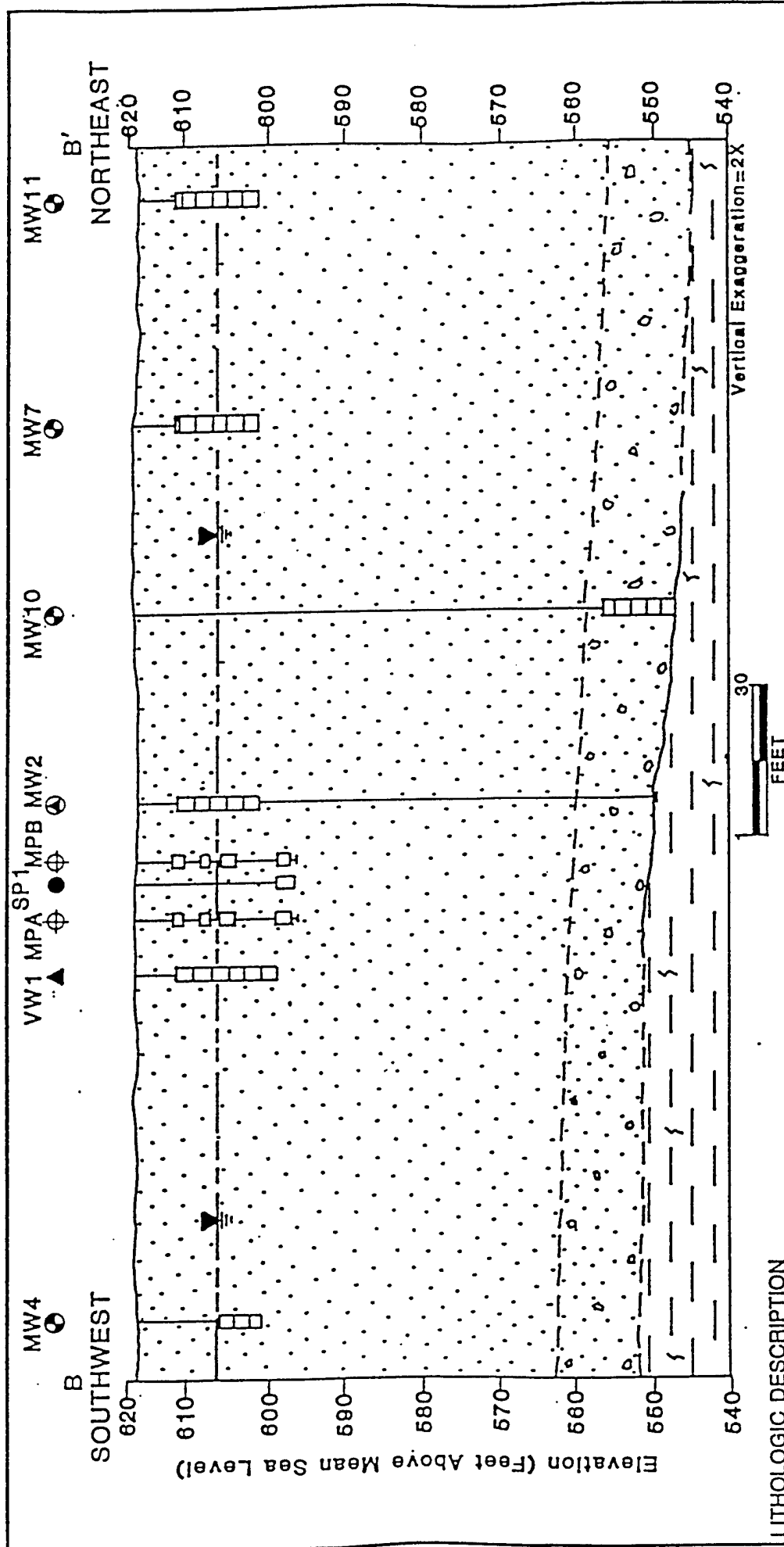


FIGURE 2.4

# HYDROGEOLOGIC CROSS SECTION B-B'

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45

Wurtsmith AFB, Michigan



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## 2.4.2 Site Hydrogeology

The water table depth at the time of well installation was approximately 10 feet bgs. Groundwater elevation data collected in October 1994 were used to construct the map of the approximate groundwater surface at Site OT45 presented in Figure 2.5. According to historic groundwater elevation data, water table elevations fluctuate approximately 1 to 3 feet annually, depending on precipitation (USGS, 1990).

Based on groundwater levels measured in site wells on October 21, 1994, shallow groundwater flow is generally to the east-northeast toward Van Etten Lake with a hydraulic gradient of 0.0042 ft/ft. The gradient appears to be uniform across the site.

The average hydraulic conductivity in the upper portion of the shallow aquifer was determined to be 110 ft/day based on slug tests performed at MPA, MW-4, MW-7, and MW-11. Hydraulic conductivity values ranged from 81 ft/day at MPA to 147 ft/day at MW-7. The average groundwater linear velocity in the shallow portion of the aquifer was calculated to be approximately 1.3 ft/day based on an average hydraulic conductivity of 110 ft/day, a gradient of 0.0042 ft/ft, and an assumed porosity of 0.35. The hydraulic conductivity in the deep portion of the shallow aquifer was determined to be 48 ft/day based on slug tests performed at MW-10. The groundwater linear velocity in the deep portion of the aquifer was determined to be 0.58 ft/day based on a hydraulic conductivity of 48 ft/day, an assumed porosity of 0.35, and assuming a hydraulic gradient of 0.0042 ft/ft (i.e., the gradient for the shallow portion of the aquifer).

## 2.5 CLIMATE CHARACTERISTICS


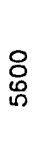









The climate at Wurtsmith AFB is humid with cold winters and short, mild summers. Mean monthly temperatures range from 21 degrees Fahrenheit (°F) in January to 68°F in July, with a mean annual temperature of 44°F. The maximum recorded temperature is 102°F, and the minimum is -22°F. Average yearly precipitation is about 30 inches, including approximately 50 inches of snow. The highest monthly precipitation (3.1 inches) normally occurs in June, and the lowest (1.6 inches) occurs in January. The prevailing wind is from the east (Lake Huron).

## 2.6 LAND USE

### 2.6.1 Site Access

Site OT45 is located near the center of the former DRMO yard, which is completely enclosed by an 8-foot-high chain-link fence topped with barbed wire. The only site access is through a locked gate located along the northern fence line near the northeast corner of the site. The interior areas of the DRMO compound are accessed via gravel driveways and staging areas. The site area is within the boundaries of Wurtsmith AFB, which is completely enclosed by a similar chain-link fence. The main access to the Base is through the main gate located on County Road F-41.

# LEGEND

-  BUILDING
-  BUILDING NUMBER
-  FENCE
-  FORMER UST LOCATION
-  GROUNDWATER MONITORING WELL (INSTALLED 1992/1993)
-  GROUNDWATER MONITORING WELL (INSTALLED 1994)
-  VENT WELL
-  VAPOR MONITORING POINT
-  AIR SPARGING POINT
-  LINE OF EQUAL ESTIMATED GROUNDWATER ELEVATION (FEET ABOVE MSL)
-  GROUNDWATER FLOW DIRECTION

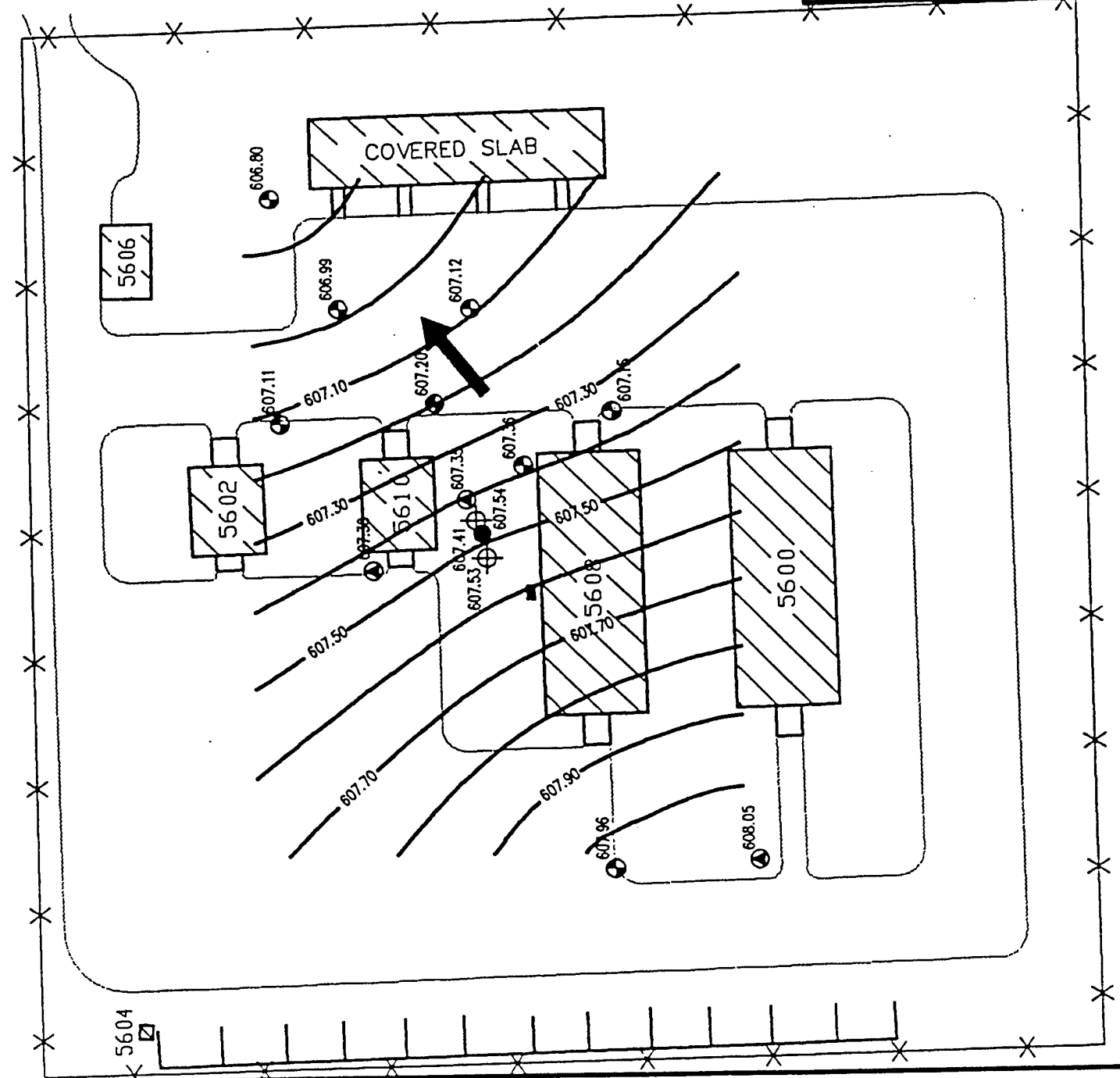


FIGURE 2.5

## GROUNDWATER SURFACE ELEVATION MAP OT45 OCTOBER 21, 1994

Remedial Action Plan  
Risk-Based Approach to Remediation  
Site OT45  
Wurtsmith AFB, Michigan



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### 2.6.2 Current Land Use

Due to the site's proximity to other facilities in the northern part of the Base, the current land use at Site OT45 could be conservatively classified as industrial. The site has been made available for several short-term RIs and treatability studies to develop data to be used to support land use/property disposal decisions.

Parcels of land immediately adjacent to Site OT45 to the north and northeast are owned by either the federal government or the State of Michigan. These parcels are zoned as forestry land, and are currently used as public facilities and/or recreation areas. The only occupied building in the vicinity of Site OT45 is the MDEQ field office located approximately 400 feet to the northeast (across County Road F-41) from the Base boundary, and 900 feet from Building 5608 (former UST location). The only other human habitation in the downgradient groundwater direction is at Camp Nissokone, a YMCA camp on Van Etten Lake, located approximately 2,500 feet from Site OT45. The nearest residential population is located approximately 3,000 feet north of Site OT45 near Van Etten Lake.

### 2.6.3 Proposed Land Use

Wurtsmith AFB was placed on the 1991 Department of Defense Base Closure and Realignment Commission's list for closure. Wurtsmith AFB was officially closed on June 30, 1993. The Air Force plans to dispose of excess and surplus real property and facilities as soon as environmental restoration is achieved, and pursuant to specific federal property disposal regulations and local community reuse plans (US Air Force, 1993). The Air Force is prepared to execute interim or long-term leases that provide maximum control over the property for some portions of the Base, and some restrictions may be necessary to ensure the protection of human health.

The Air Force, as part of the land disposal and reuse process, has been required to consult with the governor of Michigan and heads of local governments while developing conceptual property reuse plans for Wurtsmith AFB. The redevelopment agency and advisory group, authorized in January 1992 to develop potential reuse options for Wurtsmith AFB, is the Wurtsmith Area Economic Adjustment Commission (WAEAC). WAEAC is composed of a Coordinating Committee (whose membership consists of one representative each from the Boards of Trustees of Oscoda, Au Sable, and Greenbush Townships; one each from the Boards of Commissioners of Iosco and Alcona Counties; and two from the Oscoda community at large), community advisory committees, and a management and liaison office.

WAEAC makes land use recommendations to the Oscoda Township Board of Trustees, who have the authority to make decisions regarding land use options. Any recommendations from the Oscoda Township Board of Trustees on land use related to Wurtsmith AFB property are referred to the Air Force Base Conversion Agency (AFBCA), which acts as the holding agency for receipt, maintenance, and disposition of Base property under the authority of the Michigan Department of Commerce. WAEAC and the Oscoda Township Board of Trustees selected The Pathfinders, Inc. to develop a final land reuse plan for Wurtsmith AFB property. The final plan (US Air Force, 1993) was approved by the Oscoda Township Board of Trustees in December 1992.

Based on the approved final Environmental Impact Statement, and land reuse plan, Site OT45 is proposed to be reused as a commercial property dedicated to convention/tourist services (US Air Force, 1993). The planned use of this site will result in unrestricted public access, but actual occupancy will be nonresidential, intermittent in frequency, and of short duration. Most of the proposed activities will be conducted indoors, and outdoors activities will be minimal. Properties immediately to the southeast and south are proposed to be reused as industrial property, specifically light industrial, warehousing, and light manufacturing. These workers could spend the majority of their workdays outside, although most primary duties will be restricted to buildings and paved areas. The proposed land use for Site OT45 and adjacent environs is described in the *Preliminary Final Environmental Impact Statement: Disposal and Reuse of Wurtsmith Air Force Base, Michigan* (US Air Force, 1993). Additional information and figures showing current and proposed land use in and around the site are included in the *Draft Final Remedial Action Plan for Risk-Based Remediation of Site OT45*. (Parsons ES, 1996)

## 2.7 GROUNDWATER USE

Two separate water supply systems are available to meet potable and nonpotable off-Base water demands. The Oscoda Township water supply serves Oscoda and Au Sable using groundwater drawn from a shallow-aquifer well field located on the south side of the Au Sable River, which is south of the Base. Shallow groundwater is used to meet potable water demands in this area because the groundwater in the hydrogeologic units beneath the silty clay aquitard generally has high dissolved solids or high chloride concentrations, thus making it an unsuitable drinking water supply. The East Tawas water system, which serves Tawas City, the city of East Tawas, and a part of Baldwin Township, draws its water from Lake Huron (Figure 1.1).

Water for Base facilities has been supplied by Oscoda Township since April 1997. Therefore, there is no need (or plan) to continue extraction of groundwater from the shallow aquifer at Site OT45 (or any area on-Base) to meet future water supply demands.

A potable water well currently exists in the DRMO area but, has not been used since June 1993. Groundwater use restrictions have been imposed on areas where shallow groundwater contamination exists or is suspected to exist. All current lease transfers or future deed transfers on Wurtsmith AFB include prohibitions on groundwater use in potentially contaminated areas. The Michigan Department of Public Health has indicated that the existing on-Base wells could be used after closure, provided that extensive testing is conducted to monitor water quality (US Air Force, 1993).

## SECTION 3

### SOIL AND GROUNDWATER SAMPLING

#### 3.1 OVERVIEW

This section summarizes the nature and extent of chemicals of interest in soil and the dissolved chemicals in site groundwater. Analytical data for only these chemicals are presented in order to focus the remainder of this DD on these chemicals that could pose a risk to human health. The analytical data presented in this section include results from the 1992 RI, the 1994 risk-based remediation field investigation, the 1995, 1996, and 1997 groundwater sampling events and the 1996 soil sampling event. Additionally, soil gas and soil flux sampling data, which are used to estimate the areal extent of soil contamination and to identify completed exposure pathways are summarized in this section.

#### 3.2 SOURCES OF CONTAMINATION

Contamination at Site OT45 was confirmed to be the result of an underground spill from a former 1,000-gallon UST used to store heating fuel. The tank was taken out of service in October 1991, and removed in 1992 (ICF, 1993). Site characterization efforts conducted at the site previous to 1994 indicated that ethylbenzene, toluene, total xylenes, fluorene, naphthalene, and phenanthrene were potential contaminants of concern. These investigations suggested that concentrations of ethylbenzene, phenanthrene, naphthalene, and fluorene in soil could result in groundwater contamination which exceeded MDEQ residential criteria. However, results of extensive soil sampling in the source area in 1996 indicate that contaminant concentrations have naturally attenuated to levels which are below MDEQ residential criteria.

#### 3.3 SOIL GAS SAMPLING RESULTS

Soil gas samples collected at Site OT45 during the 1994 risk-based field effort were analyzed for volatile BTEX compounds and TVH contamination. Soil gas samples can be used as secondary confirmation of the nature and extent of soil contamination at a site. Soil gas samples can be used to obtain a better representation of soil contamination because the sample is extracted from a larger volume of soil than discrete soil grab samples. Analytical results from soil samples are usually nonhomogenous and can vary from sampling location to sampling location. Thus, soil gas samples provide a valuable indication of the type and magnitude of volatile organic contamination in the soil.

Soil gas samples were collected from VW-1, MPB, and MW-2 in October 1994 (Figure 3.1). Benzene was not detected in any of the three soil gas samples. This is consistent with soil data collected at the site. The only BTEX compounds detected in soil gas samples were ethylbenzene and total xylenes. These compounds were detected in all three soil gas samples collected at Site OT45 during the 1994 risk-based investigation. The maximum concentration of ethylbenzene [1.4 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ )] was detected in the soil gas sample collected at MPB; the minimum concentration ( $0.17 \text{ mg}/\text{m}^3$ ) was measured at MW-2. The maximum concentration of total xylenes ( $3.2 \text{ mg}/\text{m}^3$ ) was measured at MPB; the minimum ( $1 \text{ mg}/\text{m}^3$ ) was measured at MW-2.

These results support the 1994 soil sampling analytical results, which indicate minimal BTEX soil contamination. All of the measured soil gas concentrations are well below the time-weighted-average (TWA), 8-hour permissible exposure limits (PELs) defined for air contaminants by the Occupational Safety and Health Administration (OSHA, 1995). Consequently, if future excavation of these soils proves to be necessary to support remedial or construction activities, soil gas concentrations are not expected to pose a significant risk to potential human receptors. All analytical results for soil gas samples collected during the 1994 field effort are presented in Appendix B.

### 3.4 SOIL CHEMISTRY

Soil chemicals of interest appear to be limited to saturated and capillary fringe soils, and were not detected in unsaturated soil samples collected during either the 1992 or the 1994 sampling events. During the 1996 confirmation soil sampling event, no chemicals of interest were detected in the saturated and capillary fringe soils above the most stringent residential soil cleanup criteria. All analytical results for soil samples collected during the 1992 RI, the 1994 risk-based field efforts, and the 1996 confirmation soil sampling event are presented in Appendix B.

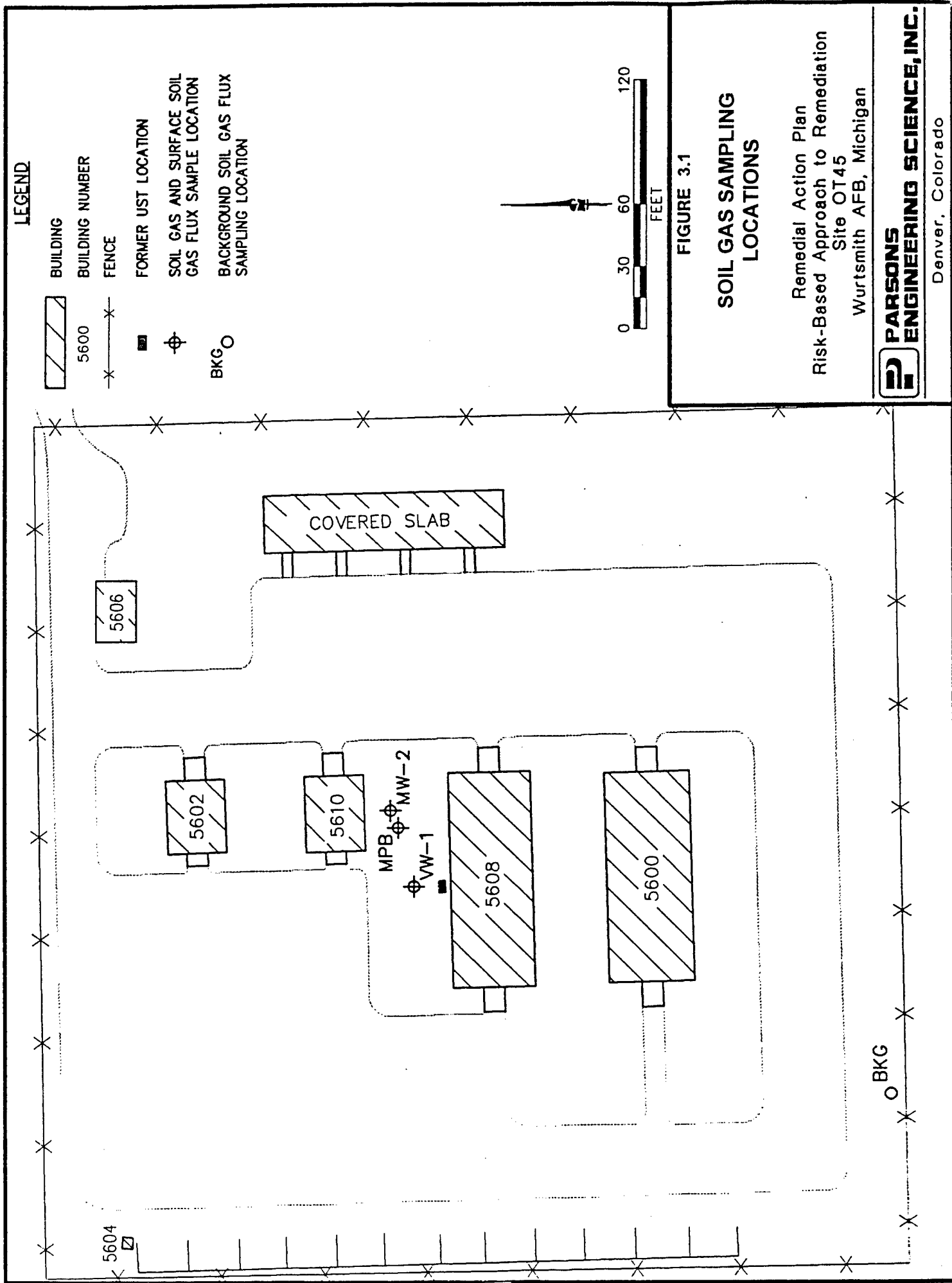
#### 3.4.1 1996 Sampling Event

The 1996 confirmation soil sampling event was completed to verify predictions of reductions in contaminant concentrations with time at the site. Twelve soil samples near the source area and two background samples were collected from the smear zone just above and below the groundwater surface (Table 3.1). The only detectable level of phenanthrene in the soil was at soil sample location C7 at a concentration of  $21 \text{ } \mu\text{g}/\text{kg}$  which was below the laboratory reporting limit (Figure 3.2). Therefore, there are currently no concentrations of 1,2,4-TMB (or any other contaminant) in site soil above the most stringent residential soil cleanup criteria. These reductions in contaminant concentrations are consistent with the predicted natural attenuation occurring at the site.

### 3.5 GROUNDWATER CHEMISTRY

The following sections describe the results of groundwater sampling events conducted during the 1992 RI, and the 1994/1995 risk-based field investigations, and the 1996/1997 groundwater verification sampling event. Only chemicals in groundwater that are present onsite at concentrations exceeding any of the MDEQ (1995a) generic residential groundwater cleanup criteria during the previous





**TABLE 3.1**  
**SOIL CONCENTRATIONS OF**  
**CHEMICALS OF POTENTIAL CONCERN**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

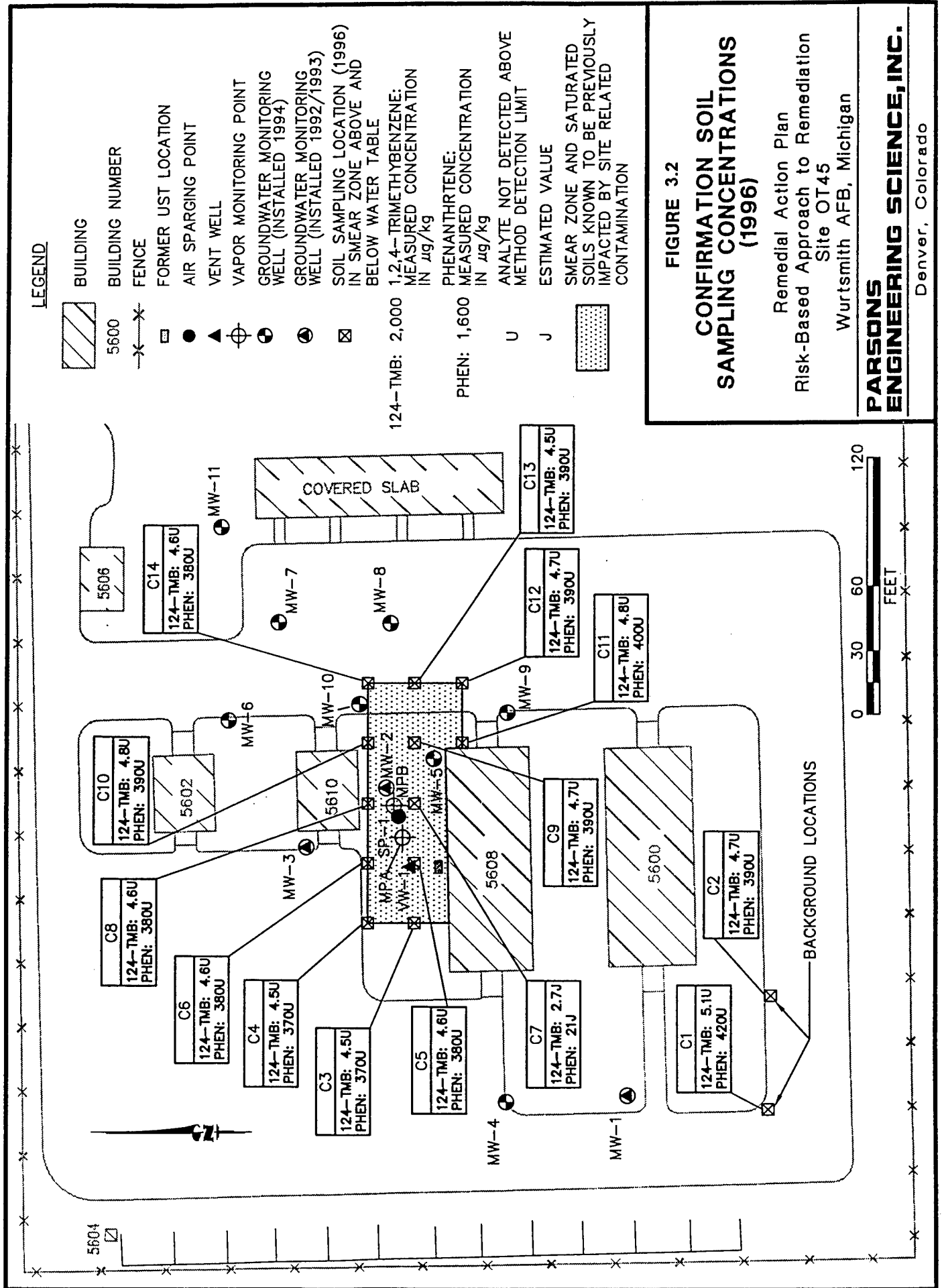
WELLS	COMPOUND	ANALYTICAL RESULTS		FEET BELOW
		July and August 1996	UNITS	GROUND SURF.
C1	1,2,4-Trimethylbenzene	5.1U	µg/kg	(8-11)
	Phenanthrene	420u	µg/kg	(8-11)
C2	1,2,4-Trimethylbenzene	4.7U	µg/kg	(8-11)
	Phenanthrene	390U	µg/kg	(8-11)
C3	1,2,4-Trimethylbenzene	4.5U	µg/kg	(8-11)
	Phenanthrene	370U	µg/kg	(8-11)
C4	1,2,4-Trimethylbenzene	4.5U	µg/kg	(8-11)
	Phenanthrene	370U	µg/kg	(8-11)
C5	1,2,4-Trimethylbenzene	4.6U	µg/kg	(8-11)
	Phenanthrene	380U	µg/kg	(8-11)
C6	1,2,4-Trimethylbenzene	4.6U	µg/kg	(8-11)
	Phenanthrene	380U	µg/kg	(8-11)
C7	1,2,4-Trimethylbenzene	2.7J	µg/kg	(8-11)
	Phenanthrene	21J	µg/kg	(8-11)
C8	1,2,4-Trimethylbenzene	4.6U	µg/kg	(8-11)
	Phenanthrene	380U	µg/kg	(8-11)
C9	1,2,4-Trimethylbenzene	4.7U	µg/kg	(8-11)
	Phenanthrene	390U	µg/kg	(8-11)
C10	1,2,4-Trimethylbenzene	4.8U	µg/kg	(8-11)
	Phenanthrene	390U	µg/kg	(8-11)
C11	1,2,4-Trimethylbenzene	4.8U	µg/kg	(8-11)
	Phenanthrene	400U	µg/kg	(8-11)
C12	1,2,4-Trimethylbenzene	4.7U	µg/kg	(8-11)
	Phenanthrene	390U	µg/kg	(8-11)

**TABLE 3.1 (Continued)**  
**SOIL CONCENTRATIONS OF**  
**CHEMICALS OF POTENTIAL CONCERN**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

WELLS	COMPOUND	ANALYTICAL RESULTS	UNITS	FEET BELOW
		July and August 1996		GROUND SURF.
C13	1,2,4-Trimethylbenzene	4.5U	µg/kg	(8-11)
	Phenanthrene	380U	µg/kg	(8-11)
C14	1,2,4-Trimethylbenzene	4.6U	µg/kg	(8-11)
	Phenanthrene	380U	µg/kg	(8-11)

U = Analyte not detected above method detection limit.

J = Estimated value.



investigations are described in detail. No free product [light nonaqueous-phase liquid (LNAPL)] has been observed at the site.

### **3.5.1 1992-1994 Sampling Event**

Results of the 1992 and 1994 sampling events indicated that, at various times, phenanthrene, 1,2,4-TMB, and 1,3,5-TMB were detected at levels above generic residential groundwater cleanup criteria in several wells near the source area. Affected wells include MW-2, MW-5, VW-1 and MPB. Not all three chemicals were detected in each well during each sampling event.

A total of 18 groundwater samples were collected during this period. The maximum concentration detected was phenanthrene at 1,500 µg/L in MW-2 during the 1992 sampling event. Phenanthrene in MW-2 in 1994 was detected at 70 µg/L. During the 1994 sampling event the remaining chemicals of concern exceeding residential cleanup criteria ranged from 36 to 82 µg/L.

### **3.5.2 1995 Sampling Event**

Results of the October 1995 sampling event demonstrate that concentrations of dissolved chemicals are rapidly decreasing at Site OT45. In October of 1995 1,2,4-TMB was the only dissolved chemical detected in onsite groundwater at concentrations greater than its residential health-based cleanup criterion of 30µg/L (Table 3.2). The 1,2,4-TMB was detected at MW-2, in the vicinity of the former UST, at a concentration of 48µg/L. All other concentrations of 1,2,4-TMB measured in groundwater samples collected during the 1995 sampling event were less than 7 µg/L. Groundwater sampling locations (MW-2, MW-4, MW-5, MW-7, MW-10, MW-11, MPB, and VW-1 [W-OT45]) were selected based on a review of the 1994 risk-based investigation results.

### **3.5.3 1996/1997 Sampling Event**

The results of the November 1996, June 1997 and November 1997 sampling events demonstrate that concentrations of dissolved chemicals have, with one exception in one well, decreased to levels below residential criteria. A limited number of sampling locations were selected based on results from previous sampling events (1994 and 1995). Wells near the source area and downgradient of the source area were sampled during the 1996 and 1997 events. No detectable levels of 1,2,4-TMB or 1,3,5-TMB were detected near the source area (MW-2) during the 1996 sampling event. 1,2,4-TMB and 1,3,5-TMB were detected at concentrations of 1 µg/L and 6 µg/L, respectively, downgradient of the source area (MW-7) during the 1996 sampling event (Table 3.2). These levels are below generic residential cleanup criteria.

Three wells near the source area (MW-2, MW-5, and VW-1) were sampled during the June 1997 sampling event. No detectable levels of 1,2,4-TMB or 1,3,5-TMB were found in any of the samples collected during this event (Table 3.2).

Two wells were sampled in the November, 1997 sampling event. Levels of 1,3,5-TMB were found to be below detection limits in MW-11 and 4 µg/L in MW-2. Levels of 1,2,4-TMB were below detection limits in MW-11 and 41 µg/L in MW-2. MW-2 is

**TABLE 3.2**  
**DISSOLVED CONCENTRATIONS OF**  
**CONTAMINANTS OF INTEREST**  
**NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

WELLS	COMPOUND	ANALYTICAL RESULTS				UNITS
		Oct-95	Nov-96	Jun-97	Nov-97	
MW-11	1,3,5-Trimethylbenzene	0.5 U	NA	NA	1.0 U	µg/L
	1,2,4-Trimethylbenzene	0.5 U	NA	NA	1.0 U	µg/L
	Phenanthrene	0.5 U	NA	NA	NA	µg/L
MW-7	1,3,5-Trimethylbenzene	5.4	6	NA	NS	µg/L
	1,2,4-Trimethylbenzene	1.8	15	NA	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L
MW-10 (deep well)	1,3,5-Trimethylbenzene	0.4 U	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	0.4 U	NA	NA	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L
MW-5	1,3,5-Trimethylbenzene	4.3	NA	0.5U	NS	µg/L
	1,2,4-Trimethylbenzene	15	NA	0.5U	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L
MPB	1,3,5-Trimethylbenzene	0.4 U	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	1.5	NA	NA	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L
VW-1	1,3,5-Trimethylbenzene	2.4	NA	0.5U	NS	µg/L
	1,2,4-Trimethylbenzene	6.4	NA	0.5U	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L
MW-2	1,3,5-Trimethylbenzene	8.7	0.2U	0.5U	4.0	µg/L
	1,2,4-Trimethylbenzene	48	0.2U	0.5U	41.0	µg/L
	Phenanthrene	6 J	NA	NA	NA	µg/L
MW-3	1,3,5-Trimethylbenzene	NS	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	NS	NA	NA	NS	µg/L
	Phenanthrene	NS	NA	NA	NS	µg/L
MW-6	1,3,5-Trimethylbenzene	NS	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	NS	NA	NA	NS	µg/L
	Phenanthrene	NS	NA	NA	NS	µg/L

**TABLE 3.2 (Continued)**  
**DISSOLVED CONCENTRATIONS OF**  
**CONTAMINANTS OF INTEREST**  
**NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

WELLS	COMPOUND	ANALYTICAL RESULTS				UNITS
		Oct-95	Nov-96	Jun-97	Nov-97	
MW-8	1,3,5-Trimethylbenzene	NS	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	NS	NA	NA	NS	µg/L
	Phenanthrene	NS	NA	NA	NS	µg/L
MW-9	1,3,5-Trimethylbenzene	NS	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	NS	NA	NA	NS	µg/L
	Phenanthrene	NS	NA	NA	NS	µg/L
MW-1	1,3,5-Trimethylbenzene	NS	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	NS	NA	NA	NS	µg/L
	Phenanthrene	NS	NA	NA	NS	µg/L
MW-4	1,3,5-Trimethylbenzene	0.4 U	NA	NA	NS	µg/L
	1,2,4-Trimethylbenzene	0.4 U	NA	NA	NS	µg/L
	Phenanthrene	0.5 U	NA	NA	NS	µg/L

NA = Data not available for comparison.

U = Analyte not detected above method detection limit.

NS = Not sampled.

near the source area and the 41 µg/l of 1,2,4-TMB is above the residential cleanup limit of 30 µg/L, but below the commercial/industrial limit of 86 µg/l.

The 1996 and the June 1997 sampling events indicate that dissolved phase 1,2,4-TMB and 1,3,5-TMB existed at concentrations below the most restrictive MDEQ (1995a) generic health-based residential groundwater cleanup criterion of 30 µg/L and 23 µg/L. The November 1997 sampling event shows that 1,2,4-TMB in MW-2 is slightly above the residential cleanup criterion, but remains below the commercial / industrial criterion. These slight variations in 1,2,4-TMB above and below the residential criteria are likely to continue due to seasonal changes in groundwater elevation which expose the source area groundwater to varying degrees of soil contamination.



## SECTION 4

### EXPOSURE ASSESSMENT

Wurtsmith AFB was officially closed on June 30, 1993. Based on the approved final land reuse plan, Site OT45 has been set aside for potential commercial development (convention center) (US Air Force, 1993). Surrounding land use is primarily industrial. The site was formerly used as a storage and staging area for DRMO operations, and is currently vacant except for intermittent remediation investigations and efforts. Site OT45 is located about 200 feet upgradient from the nearest Base property boundary, which borders US government and State of Michigan parcels that are zoned forestry land, and are currently used as recreation areas/public facilities. Additionally, there are some residences outside of the Base boundary near Van Etten Lake, which is approximately 3,000 feet downgradient from the site.

Considering the land use plans for this site and the limited activities currently taking place in the area, the site will continue to be maintained as an industrial area until completion of any convention/tourist center. After completion of the convention/tourist facilities, site activities are anticipated to be similar to the activities and exposure assumptions for the commercial subcategory IV site described in Operational Memorandum #14 (MDEQ, 1995b).

Based on these land use assumptions, onsite industrial workers and eventually commercial subcategory IV workers and visitor populations are the only current or likely future onsite human receptors. As there are no long-term plans for the use of groundwater from the shallow affected aquifer, and as depth to groundwater at the site is about 10 feet bgs, current onsite workers could reasonably be exposed only to impacted surface soils and to air potentially affected by chemicals volatilizing from subsurface media in the absence of any deep (10 feet bgs or more) excavation activities. However, future workers could also include those involved in construction or other intrusive maintenance activities. Therefore, future onsite workers could be exposed to contaminants in surface and subsurface soils, air, and, conservatively, shallow groundwater.

No exposure pathways to current offsite receptors are believed to be completed. In light of the existence of off-Base potable water wells completed in the affected shallow aquifer, future offsite human receptors could potentially be exposed to site contaminants through ingestion or inhalation of, or dermal contact with, contaminants in groundwater extracted for potable use. However, the nearest residential area using shallow groundwater is over 3,000 feet from the site, and downgradient contaminant migration from the site to date is less than 200 feet.

Although numerous plant and wildlife species are known to occur on and near Wurtsmith AFB, the absence of contaminant migration pathways in media to which wildlife or plants could readily be exposed (e.g., surface water and shallow soils) indicates that no ecological receptors are likely to be exposed to contaminants in site media under current or anticipated future land uses.

A more detailed exposure assessment, including a conceptual site model, and chemical fate assessment is provided in the *Draft Final Remedial Action Plan for the Risk-Based Remediation of Site OT45* (Parsons ES 1996)

## SECTION 5

### SUMMARY

Site OT45 has very little soil and groundwater contamination remaining. The lack of soil contamination is evidenced by results from 14 soil samples collected in 1996 from the smear zone in the area around the tank pit source area. Soil concentrations of chemicals of concern are below residential direct contact clean-up criteria. A listing of maximum detected concentrations and residential direct contact clean-up criteria is provided in Table 5.1. Note that none of the maximum soil concentrations exceeds any clean-up criteria.

The lack of groundwater contamination is evidenced by the 1996 and June 1997 groundwater sampling in which no exceedances of residential health-based cleanup criteria were observed. The November 1997 sampling event indicates that MW-2 contains levels of 1,2,4-TMB slightly above residential cleanup criteria, but below commercial / industrial criteria. Table 5.2 contains maximum detected concentrations from the 1996 and 1997 sampling events and residential health-based clean-up criterion. Note that the only exceedance is for one compound in one well. Analysis of all available site groundwater data shows a decreasing trend in chemical concentrations from initial sampling in 1992 until 1997.

**TABLE 5.1**  
**COMPARISON OF SOIL RESULTS TO CLEAN-UP CRITERIA**  
**NO FURTHER REMEDIAL ACTION PLANED DECISION DOCUMENT**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Analytes	Maximum Detected Concentrations 1996	Residential Direct Contact	Residential Leaching to Groundwater	1996 Max. Conc. Exceeds Any Criteria	Units
Acenaphthene	<420	7.60E+07	3.00E+05 {M}	No	µg/kg
Benzo(a)anthracene {Q} {DC}	<420	14,000	{E}	No	µg/kg
Benzo(a)pyrene {Q} {DC}	<420	1,400	{E}	No	µg/kg
Benzo(b)fluoranthene {Q} {DC}	<420	14,000	{E}	No	µg/kg
Benzo(g,h,i)perylene	<420	1.50E+06	{E}	No	µg/kg
Benzo(k)fluoranthene {Q} {DC}	<420	1.40E+05	{E}	No	µg/kg
Chrysene {Q} {DC}	<420	1.40E+06	{E}	No	µg/kg
Dibenzofuran	<420	{ID}	{ID}	--	µg/kg
Ethylbenzene	0.6	>C <sub>sat</sub> (3.80E+05)	1,500	No	µg/kg
Fluoranthene	<420	5.10E+07	3.00E+06 {M}	No	µg/kg
Fluorene	<420	5.10E+07	3.90E+05 {M}	No	µg/kg
Indeno(1,2,3-cd)pyrene {Q} {DC}	<420	14,000	{E}	No	µg/kg
2-Methylnaphthalene	110	1.50E+07	5,200	No	µg/kg
Naphthalene	35	1.50E+07	17,000 {M}	No	µg/kg
Phenanthrene	21	1.50E+06	12,000 {M}	No	µg/kg
Pyrene	58	3.20E+07	1.80E+06 {M}	No	µg/kg
Toluene	0.9	>C <sub>sat</sub> (6.20E+05)	16,000	No	µg/kg
1,2,3-Trimethylbenzene	1.3	--	--	--	µg/kg
1,2,4-Trimethylbenzene	2.7	4.50E+05	600	No	µg/kg
1,3,5-Trimethylbenzene	2.3	3.40E+05	460	No	µg/kg
Total xylenes	2.3	>C <sub>sat</sub> (4.00E+05)	5,600	No	µg/kg

Source: MDNR, 1996.

C<sub>sat</sub> = Soil saturation value.

{DC} = Chemical is a dermal carcinogen, since it causes skin cancer directly at the point of contact. Value is based on the oral slope factor due to lack of dermal toxicity data.

{E} = Chemical, due to its physiochemical properties, is not expected to leach through soils to groundwater under most conditions.

{ID} = Inadequate data to develop RBSL.

{M} = A linear equilibrium soil/water partitioning equation (SWP) was substituted for the 20X groundwater value where the SWP value was higher. The SWP predicts the contaminant release from soil into soil leachate by relating the concentration of contaminants absorbed to soil organic carbon to the concentration in the soil water and air pore space. The method also accounts for contaminant transport by applying a generic dilution attenuation factor (DAF) to represent the dilution in soil leachate concentrations that result from contaminants mixing in an aquifer. The DAF is defined as the ratio of the soil leachate concentration to the acceptable groundwater concentration. A DAF of 16 was agreed upon by technical staff within the DEQ. The equation can be found in EPA's Soil Screening Guidance, published by the Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R95/128 1996

{Q} = RBSLs for carcinogenic polynuclear aromatic hydrocarbons (PNAs) were calculated using "relative potential potencies" (RPPs) to benzo(a)pyrene.

**TABLE 5.2**  
**COMPARISON OF GROUNDWATER RESULTS TO CLEAN-UP CRITERIA**  
**NO FURTHER REMEDIAL ACTION PLANNED DECISION DOCUMENT**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Analytes	Maximum Detected Concentration			Residential Health-Based/ Aesthetic Drinking Water	Industrial Commercial Health-Based	State Drinking Water	1997 Max. Conc. Exceeds Any	Units
	Jun-97	Nov-96	Nov-97	Criterion	Criterion	Standards <sup>u/</sup>	Criteria	
Acenaphthene	NA	NA	NA	1,300	3,800	--	No	µg/L
Anthracene	NA	NA	NA	7,300	21,000	--	No	µg/L
Benzene	<0.5	<5	NA	5 {C}	5 {C}	5	No	µg/L
Ethylbenzene	<0.5	7	4	74 {A}	74 {A}	700	No	µg/L
Fluorene	NA	NA	NA	880	2,500	--	No	µg/L
2-Methylnaphthalene	NA	NA	NA	260	750	--	--	µg/L
Naphthalene	NA	NA	98	260	750	--	No	µg/L
Phenanthrene	NA	NA	NA	26	75	--	No	µg/L
1,2,3,4-Tetramethylbenzene	7.4	NA	NA	--	--	--	--	µg/L
Toluene	<0.5	<5	NA	790 {A}	790 {A}	1,000	No	µg/L
1,2,3-Trimethylbenzene	<0.5	1	NA	--	--	--	--	µg/L
1,2,4-Trimethylbenzene	<0.5	1	41	30	86	--	Yes	µg/L
1,3,5-Trimethylbenzene	<0.5	6	4	23	65	--	No	µg/L
Total xylenes	<0.5	2	6	280 {A}	280 {A}	10,000	No	µg/L

Source: MDNR, 1996.

<sup>u/</sup> The state drinking water standard must be met onsite if groundwater is used as an onsite potable water source, and the standard is more restrictive than the health-based or aesthetic criteria.

{A} = This identifies the aesthetic value which is more restrictive than the health based value.

{C} = State of Michigan Drinking Water Standard established pursuant to Section 5 of the Safe Drinking Water Act, Public Act 399 of 1976 used as default.

## **SECTION 6**

### **DESCRIPTION OF THE NFRAP ALTERNATIVE**

This section summarizes the recommendation for no further action at Site OT45.

#### **6.1 RECOMMENDATION FOR CLOSURE**

Based on the site investigation and evaluations, the potential threat to public health or the environment at Site OT45 is negligible. Due to transient levels of 1,2,4-TMB in MW-2 above residential cleanup criteria, but below commercial / industrial limits, it is recommended that the site be closed under commercial / industrial criteria. Additional sampling of monitoring wells is not proposed at this time and would only be required if groundwater was ever needed for residential use.

The decision for no further remedial action planned (NFRAP) is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost effective. Site OT45 will be removed from further consideration in the Wurtsmith AFB IRP.

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**APPENDIX A**

**BORING LOGS, WELL CONSTRUCTION DIAGRAMS, AND  
WELL DEVELOPMENT DATA**

# BOREHOLE LOG

SITE NAME AND LOCATION <b>Wurtsmith AFB</b> <b>DT45</b>		DRILLING METHOD: <b>HSA</b>				BORING NO. <b>MW4-0T45</b>	
						SHEET <b>1</b> OF <b>1</b>	
		SAMPLING METHOD: <b>Split spoon</b>					
						DRILLING	
Collected MS-HSD Temporary well - completed as permanent well		WATER LEVEL <b>9.5</b>				START TIME	FINISH TIME
		TIME				<b>15:15</b>	<b>16:00</b>
		DATE				DATE	DATE
		CASING DEPTH				<b>9/29/94</b>	<b>9/29/94</b>

RIG		SURFACE CONDITIONS	
BEARING			
SAMPLE HAMMER TORQUE		FT.-LBS	

ELEVATION (FEET)	BLOWS/ AMPERE ON SAMPLER (RECOVERY)	CORES				SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS			
		RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET		PERMEABILITY CM./SEC.	
												FROM	TO		
2						0-1 SAND f-m		dk brn							
4						1-2 SAA, orange		brn							
6	23	54				SAND, f-m, tan						5	7	22	
8	33					sm Fe stain, moist									
10	33.2					SAA						8	10	4 ppm TKU	
12						9.5 f. gr. md brn		Fe stain							
14	7.7					1/2" silty clay @ 9.8		WL drilled 9.5							
16	21							TD=15'				13	15	TOL COPPER	
18	21														
20															
22															
24															
26															
28															
30															
32															
34															
36															
38															
40															
42															
44															
46															
48															
50															
52															
54															
56															
58															
60															
62															
64															
66															
68															
70															
72															
74															
76															
78															
80															
82															
84															
86															
88															
90															
92															
94															
96															
98															
100															

Figure A.1  
Geologic Boring Log

DRILLING CONTR **CTI**

RL

LOGGED BY **JFH**  
 DATE **9/29/94** CHK'D BY

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

SITE NAME AND LOCATION Hartsmith AFB T45	DRILLING METHOD: HSA				BORING NO. MW7-0745	
					SHEET 5	
	SAMPLING METHOD: Split spoon				( 1 OF 1 )	
					DRILLING	
					START	FINISH
WATER LEVEL		9.5			TIME	TIME
TIME					0738	09:00
DATE					DATE	DATE
					9/29/94	9/29/94
CASING DEPTH						

DIP & RIG		SURFACE CONDITIONS	
BEARING			
SAMPLE HAMMER TORQUE		FT.-LBS	

BLOWS/BLANK ON SAMPLER (RECOVERY)	CORES			SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS			
	RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY							RQD	DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	

3777				Sand, dk brn Sand orange-brn Sand, tan, m-gr nu SAA, f m-gr, f-gr		Moist at 4'						
5456				SAA, md-gr ~ 1" clay layer		wet @ 4.5' at 9.4' no odor						
516 32 30				SAA m-c gr.		Cuttings, green fuel odor TD=16						

Figure A.1  
Geologic Boring Log

DRILLING CONTR CTI

LOGGED BY JFH  
DATE 9/29/94 CHK'D BY RL

# BOREHOLE LOG

SITE NAME AND LOCATION <b>Jurtsmith AFB 0T45</b>	DRILLING METHOD: <b>HSA</b>				BORING NO. <b>HW6-0T45</b>	
					SHEET	
	SAMPLING METHOD: <b>Split Spoon</b>				OF	
					DRILLING	
					START	FINISH
WATER LEVEL <b>9.5</b>					TIME <b>12:40</b>	TIME <b>1315</b>
TIME					DATE <b>9/29/94</b>	DATE <b>9/29/94</b>
DATE						
CASING DEPTH						

D. RIG		SURFACE CONDITIONS	
B. LE BEARING			
SAMPLE HAMMER TORQUE FT.-LBS			

BLOWS/ANK ON SAMPLER (RECOVERY)	RUN NO.	CORES		SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS			
		NO. AND SIZE OF CORE PIECES	% RECOVERY							ROD	DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	

				Sand, m-f gr top		6'-1' dk brn 1'-2' orange-brn						
40	55			SAND, tan-orange 4-5 med gr 5-6 fine gr		- tan, moist				4	6	>2ppm
56	77			SAA, Fe stain 9-10 interbedded Fe stain no odor SAND, m-c gr. tan		WL drilled 9.5' SAND & silt clay, SILT wet no odor				8	10	Lab 5ppm
510	1477			SAA 1/2" silt layer @ 14'						10	12	5ppm
				TD 15'						13	15	12ppm

DRILLING CONTR **CTI**

LOGGED BY **JFH**

DATE **9/29/94** CHK'D BY **RL**

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

SEE NAME AND LOCATION

Jarvis AFB

DRILLING METHOD:

HSA 3 1/4 ID

BORING NO.

MW 7

CHANG 21 6 484

SHEET

1 OF 1

SAMPLING METHOD:

0-8 5' core barrel

DRILLING

8- 2' split spec.

START

FINISH

WATER LEVEL 9.0

TIME

TIME

TIME

1650

0

DATE

DATE

DATE

CASING DEPTH

9/27

9/28

DIAMETER

ELEVATION

WELL RIG ACER SOIL MAX

SURFACE CONDITIONS

ANGLE BEARING

SAMPLE HAMMER TORQUE

FT.-LBS

BLOWS/ AM ON SAMPLER (RECOVERY)	CORES				SOIL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS			
	RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET		TUV PERMEABILITY (CM/SEC.)	
											FROM	TO		
					Gravel pavement SAND, f-m, tan- orange-brn lam. no odor, moist						0	2.5	15 ppm	
					SAA - 5' light color, ~ 1/2" silt @ ~ 7'						2.5	7.5	8 ppm	
					SAND, f-m, thin sl clayey silt lenses ~ Fe stain, no odor SAND, f-m, tan wet no odor		WL drilled ~ 9'				8	10	10 ppm lab	
					SAA, incr. gr size coarse-VC @ 17'		TDC 15' 1823							

Figure A.1  
Geologic Boring Log

DRILLING CONTR CTI

RL

LOGGED BY JFH

DATE 9/27/94 CHK'D BY

Figure A.1  
Geologic Boring Log

Contnt. # water in bag 20-30 ppm

# BOREHOLE LOG

SITE NAME AND LOCATION <b>1 Surt Smith AFB</b> <b>OT45</b>		DRILLING METHOD: <b>HSA</b>				BORING NO. <b>MW8-OT45</b>	
						SHEET <b>1</b> OF <b>1</b>	
		SAMPLING METHOD: <b>Split Spoon</b>					
						DRILLING	
		WATER LEVEL <b>9.5</b>				START TIME <b>13:55</b>	FINISH TIME
		TIME				DATE	DATE
		DATE				<b>9/29/94</b>	<b>9/29/94</b>
ELEVATION		CASING DEPTH					

RIG		SURFACE CONDITIONS	
BEARING			
SAMPLE HAMMER TORQUE		FT.-LBS	

BLOWS/AM ON SAMPLER (RECOVERY)	RUN NO.	CORES			SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
		NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	
					6" Gravel SAND - f-mgr		orange-brn						
					SAND, f-mgr orange-tan, Fe stain, moist						5	7	12ppm
					SAND 9' Fastain 4.5 SAND, fgr & silt SAND md brn 11' m-cgr 1" silt @ ~11'		Wet @ 9-9.5 brn - orange brn no odor				8	10	lub 12ppm
					SAND f-mgr md brn wet no odor		TD=15'				10	12	9ppm
											13	15	10ppm

CTI  
DRILLING CONTR

RL

LOGGED BY **JFH**

DATE **9/29/94** CHK'D BY

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

SITE NAME AND LOCATION Jurtsmith AFB BT 45 1. of bldg 5608		DRILLING METHOD: HSA				BORING NO. MW90T45	
						SHEET 1 OF 1	
		SAMPLING METHOD: Split Spoon					
						DRILLING	
						START	FINISH
		WATER LEVEL	9.5			TIME	TIME
		TIME				0910	10:00
		DATE				DATE	DATE
DATE		CASING DEPTH				9/27/44	9/29/44
ELEVATION							

OF L RIG		SURFACE CONDITIONS
SALE	BEARING	
SALE HAMMER TORQUE	FT.-LBS	

[illegible]

DRILLING CONTR C TI



LOGGED BY JFH  
DATE 7/29/94 CHK'D BY

**Figure A.1**  
**Geologic Boring Log**



# BOREHOLE LOG

NAME AND LOCATION

Wurtsmith  
OT-45

DRILLING METHOD:

Hollow Stem

BORING NO.

MW1010 D

SHEET

1 OF 2

DRILLING

SAMPLING METHOD:

2-inch

Split Spoon

START

FINISH

WATER LEVEL

TIME

DATE

CASING DEPTH

TIME

DATE

DATE

10-3-96

ELEVATION

RIG Acker Drill Max

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/ AN  
ON SAMPLER  
(RECOVERY)

RUN NO.

NO. AND SIZE  
OF  
CORE PIECES

% RECOVERY

ROD /

SOIL DESCRIPTION  
OR  
ROCK LITHOLOGY

SYMBOL

ROCK  
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT  
ON CASING

TEST RESULTS

DEPTH  
IN  
FEET

FROM

TO

PERMEABILITY  
CM./SEC.

DRILLING CONTR

RL

LOGGED BY N. Marcelletti

DATE 10/3/96 CHK'D BY

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

NAME AND LOCATION

DRILLING METHOD:

BORING NO.

Hollow Stem Auger

MW0100

SAMPLING METHOD: 2-inch Split  
- Spoon

SHEET  
2 of 3  
DRILLING

WATER LEVEL

START

FINISH

TIME

TIME

TIME

DATE

DATE

DATE

CASING DEPTH

ELEVATION

RIG

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/ FEET  
ON SAMPLER  
(RECOVERY)

RUN NO.

NO. AND SIZE  
OF  
CORE PIECES  
% RECOVERY

ROD

SOL DESCRIPTION  
OR  
ROCK LITHOLOGY

SYMBOL

ROCK  
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT  
ON CASING

TEST RESULTS

DEPTH  
FEET

FROM

TO

PERMEABILITY  
CM./SEC.

DRILLING CONTR

7  
14  
18  
23

3

1

66

20

Same as  
above

21  
18  
23  
30

4

1

100

29

Sand Med-coarse  
trace fine gravel  
Wet Yellowish Brown 10YR 5/4  
Very Dense

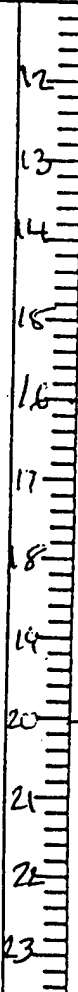


Figure A.1  
Geologic Boring Log

LOGGED BY

DATE

RL

CHK'D BY

# BOREHOLE LOG

NAME AND LOCATION

Wurtsmith  
OT-45

DRILLING METHOD:

Hollow Stem

BORING NO.

MW01010

SHEET

3 of 6

SAMPLING METHOD:

2-inch Split

Spcon

DRILLING

START

FINISH

WATER LEVEL

TIME

TIME

TIME

11:50

DATE

DATE

DATE

CASING DEPTH

10-5-94

ELEVATION

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/IN.  
ON SAMPLER  
(RECOVERY)

RUN NO.

NO. AND SIZE  
OF CORE  
PIECES

% RECOVERY

ROD

SOL DESCRIPTION  
OR  
ROCK LITHOLOGY

SYMBOL

ROCK  
STRUCTURE

SAMPLER AND BIT

CASINO TYPE

BLOWS/FOOT  
ON CASINO

TEST RESULTS

DEPTH  
IN  
FEET

FROM

TO

PERMEABILITY  
CM./SEC.

DRILLING CONTR

No Recovery

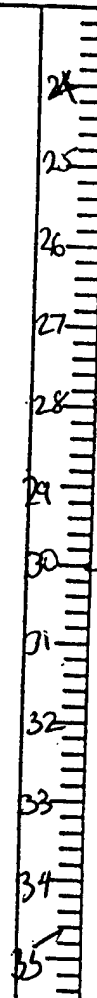


Figure A.1  
Geologic Boring Log

LOGGED BY

DATE \_\_\_\_\_ CHK'D BY \_\_\_\_\_

RL

# BOREHOLE LOG

NAME AND LOCATION

Wurtsmith  
OT-45

DRILLING METHOD:

Hollow Stem

BORING NO.

MW010D

SHEET

4 of 7

SAMPLING METHOD:

2-inch Split

Spoon

DRILLING

WATER LEVEL

TIME

DATE

CASING DEPTH

START

FINISH

TIME

TIME

11:50

DATE

DATE

10-5-94

ELEVATION

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/ FT.  
ON SAMPLER  
(RECOVERY)

RUN NO.

NO. AND SIZE  
OF  
CORE PIECES  
% RECOVERY

ROD/FT.

SOL DESCRIPTION  
OR  
ROCK LITHOLOGY

SYMBOL

ROCK  
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT  
ON CASING

TEST RESULTS

DEPTH  
IN  
FEET

PERMEABILITY  
CM./SEC.

FROM

TO

DRILLING CONTR

8  
12  
12  
20

6

1

18

25

Sand fine-med  
Light yellowish Brown Wet  
10 YR 6/4 Dense

36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

RL

LOGGED BY

DATE

CHK'D BY

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

NAME AND LOCATION

DILLING METHOD: *Hollow Stem*

BORING NO.

*Auger*

*MW010 D*

SHEET

SAMPLING METHOD: *2-luck*

*5 of 6*

*split spoon*

DILLING

WATER LEVEL

START

FINISH

TIME

*11:50*

TIME

DATE

DATE

DATE

CASING DEPTH

*10-590*

ELEVATION

RIG SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE FT.-LBS

BLOWS/BL ON SAMPLER (RECOVERY)	CORES				SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
	RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD / P							DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	

*14  
13  
13  
19*

*1 1006.8*

*Sand fine-med wet same as above*

*48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59*

*8  
12  
15  
21*

*8 1 60 1.2*

*Sand med  
1-2 3/4 from bottom  
Fine to med gravel wet  
Light yellowish Brown  
10496/4 dense*

*60 on next  
Figure A.1 pag-  
Geologic Boring Log*

DRILLING CONTR

LOGGED BY

RL

DATE \_\_\_\_\_ CLK'D BY \_\_\_\_\_

# BOREHOLE LOG

NAME AND LOCATION

Wartsmith  
OT-45

DRILLING METHOD:

BORING NO.

MW010b

SHEET

6 OF 6

SAMPLING METHOD:

DRILLING

WATER LEVEL

TIME

DATE

CASING DEPTH

START

TIME

DATE

FINISH

TIME

DATE

ELEVATION

SURFACE CONDITIONS

BEARING

LE HAMMER TORQUE

FT.-LBS

BLOWS/AM  
ON SAMPLER  
(RECOVERY)

CORES

RUN NO.

NO. AND SIZE  
OF  
CORE PIECES

% RECOVERY

ROD/PCF

SOL DESCRIPTION  
OR  
ROCK LITHOLOGY

SYMBOL

ROCK  
STRUCTURE

SAMPLER AND BIT

CASING TYPE

BLOWS/FOOT  
ON CASING

TEST RESULTS

DEPTH  
IN  
FEET

FROM

TO

PERMEABILITY  
CM./SEC.

DRILLING CONTR

RL

LOGGED BY

DATE CHK'D BY

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

NAME AND LOCATION		DRILLING METHOD: Hollow Stem				BORING NO.	
Wurtsmith OT-45 MW010-OT45		Auger				MW010-OT45	
						SHEET	
		SAMPLING METHOD: 2-inch Split				1 OF 2	
		Spoon				DRILLING	
						START	FINISH
		WATER LEVEL	9 ft			TIME	TIME
		TIME	1:11			12:55	
		DATE	10-3-94			DATE	DATE
		CASING DEPTH	20 ft			10-3-94	
ELEVATION		SURFACE CONDITIONS					
D: 2 RIG		Acker Soil Max					
ANGLE 0		BEARING 0					
SAMPLE HAMMER TORQUE		FT.-LBS					

[illegible]

Depth (ft)	Diameter (in)	Description
6.9	4.0	Sand fine dry Very Pale Brown 10YR 7/3
5.5	4.0	Sand med wet Yellowish Brown 10YR 5/4

Figure A.1  
Geologic Boring Log

**DRILLING CONTR**

日

LOGGED BY Duke Maxwell

DATE 1-3-94 CHK'D BY

**Figure A.1**  
**Geologic Boring Log**

# BOREHOLE LOG

SITE NAME AND LOCATION <b>Wurtsmith AFB OT-45 MW010-OT45</b>		DRILLING METHOD: <b>Hollow Stem</b>		BORING NO. <b>MW010-OT45</b>	
		<b>Auger</b>		SHEET <b>2 of 2</b>	
		SAMPLING METHOD: <b>2-inch</b>		DRILLING	
		<b>Split Spoon</b>			
		WATER LEVEL <b>9ft</b>		START	FINISH
		TIME <b>1:11</b>		TIME	
		DATE <b>10-3-94</b>		DATE	DATE
		CASING DEPTH			
ELEVATION		10-3-94			

RIG <b>Acker Soil Max</b>		SURFACE CONDITIONS <b>Level Paved</b>	
BEARING <b>0</b>			
SAMPLE HAMMER TORQUE		FT.-LBS	

BLOWS/AM ON SAMPLER (RECOVERY)	CORES				SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
	RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD/PTD							DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	
7 8 14 23	3	1 12	60	2.0	Sand Med Wet Yellowish Brown 104R 5/4								
2 18 23 30	4	1 24	100	2.0	Sand med-coarse Trace fine gravel Wet Yellowish Brown 104R 5/4								
						EO B							

Figure A.1  
Geologic Boring Log

DRILLING CONTR **CTI**

RL

LOGGED BY **Dick Marcelle**

DATE **10-3-94** CHK'D BY

Figure A.1  
Geologic Boring Log



BOREHOLE LOG															
SITE NAME AND LOCATION T45 Wurtsmith AFB							DRILLING METHOD: HSA					BORING NO. MW 10-OT45			
												SHEET 1 OF 1			
COUNT BTEX, PNA, TOC CONCENTRATION GRADIENT OF MW 7							SAMPLING METHOD: Split spoon					DRAINAGE			
ELEVATION							WATER LEVEL 9					START TIME		FINISH TIME	
							DATE					DATE 10/6/94		DATE 10/6/94	
RIG							SURFACE CONDITIONS								
BEARING															
HAMMER TORQUE FT.-LBS															
BLOWS/AN ON SAMPLER (RECOVERY)	RUN NO.	CORES			SOIL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASINO TYPE	BLOWS/FOOT ON CASINO	TEST RESULTS				
		NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET	PERMEABILITY CM./SEC.			
											FROM	TO			
					SAND, f-mgr dk brn		moist								
3455					SAND, uf-f, t SILT		orange-tan, moist				5	7	2 ppm		
2222					SAND, f-mgr orange wet @ 8' festain 9.5' CLAY SILT		-tan, v. moist md brn, wet, soft				8	10	<2 ppm		
2445					SAND, f-C gr, lt		brn, wet WL drilled 9'				10	12	S1 <2 ppm		
3669					SAA		TO=15'				12	14	S2 4 ppm		

DRILLING CONTR CTI

water blank 8 ppm

Figure A.1  
Geologic Boring Log

A-8

LOGGED BY JFH  
DATE 10/6/94 CHK'D BY RL

• 二

LOGGED BY JFH

DATE 10/6/94 CHK'D BY

**Figure A.1**  
**Geologic Boring Log**

# BOREHOLE LOG

SITE NAME AND LOCATION  UWI-0T45 Nurtsmith AFB	DRILLING METHOD: HSA				BORING NO.	
					UWI-0T45	
	SAMPLING METHOD: Spl: + Spoon				SHEET	
					1 OF 1	
					DRILLING	
					START	FINISH
	WATER LEVEL 9.5				TIME	TIME
TIME				0910		
DATE				DATE		
				9/28/94 9/28/94		
CASING DEPTH						

ELEVATION		SURFACE CONDITIONS	
BEARING			
SAMPLE HAMMER TORQUE		FT.-LBS	

BLOWS/ FEET ON SAMPLER (RECOVERY)	RUN NO.	CORES			SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
		NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	

					SAND, f-m gr upper 6" dk brn then tan, orange, moist no odor						3	8	PI 0
											3	5	15 ppm
6764					SAND, md gr, lt brn t, 9.5 then gray diesel odor. @ top of sat zone, 9.5 thin SILT layer Fe Stain		WL drilled 9.5'				7.5	9.5	30 ppm
					SAND, lt brn, m gr, to VC. no odor						15	17	

Figure A.1  
Geologic Boring Log

DRILLING CONTR C77

LOGGED BY JFH

RL

DATE 9/28/94 CHK'D BY

# BOREHOLE LOG

SITE NAME AND LOCATION <b>Wurtsmith AFB</b> <b>OT45</b>				DRILLING METHOD: <b>HSA</b>				BORING NO. <b>MPA-OT45</b>	
								SHEET <b>1 OF 1</b>	
				SAMPLING METHOD: <b>Split Spoon</b>					
								DRILLING	
				WATER LEVEL		START TIME <b>10:50</b>		FINISH TIME	
				TIME					
				DATE		DATE <b>9/28/94</b>		DATE <b>9/28/94</b>	
CASING DEPTH									
ELEVATION				SURFACE CONDITIONS					
BEARING									
SAMPLE HAMMER TORQUE FT.-LBS									

BLOW/AN ON SAMPLER (RECOVERY)	RUN NO.	CORES			ROD	SOIL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
		NO. AND SIZE OF CORE PIECES	% RECOVERY	DEPTH IN FEET								PERMEABILITY CM./SEC.		
													FROM	TO
1345														
3454														
2247														
2379														
71214														
791316														
5914														

**SAND, LT brn, fgr. moist**

**SAA some Fe stain**

**SAA sl odor, f-m gr**

**9' SAA - gray, odor**

**SAND, M-gr, gray**

**fuel odor ~ 1/2" silt**

**@ ~ 11', uf-gr @ 12'**

**SAND, f-uc, tr f gravel**

**fuel odor, lt brn & grey**

**SAND, M-uc, lt brn**

**SAA, f-c**

**SAA**

**SAA, 1/2" silt layer @ ~ 19'**

**U.L. drilled 9-9.5**

**TD=20**

LOGGED BY **JFH**

DATE **9/28/94** CHK'D BY **RL**

DRILLING CONTR **CTI**

Figure A.1  
Geologic Boring Log

# BOREHOLE LOG

NAME AND LOCATION <b>Wurtsmith AFB</b> <b>OT45</b>		DRILLING METHOD: <b>HSA</b>		BORING NO. <b>MPB-OT45</b>	
		6 1/2" ID		SHEET <b>1 OF 1</b>	
		SAMPLING METHOD: <b>Split Spoon</b>		DRILLING	
				START	FINISH
		WATER LEVEL	<b>9.5</b>	TIME	TIME
		TIME		<b>14:10</b>	<b>15:10</b>
		DATE		DATE	DATE
		CASING DEPTH		<b>9/28/94</b>	<b>9/28/94</b>

ELEVATION		SURFACE CONDITIONS	
BEARING			
SAMPLE HAMMER TORQUE		FT.-LBS	

BLOWS/BLK ON SAMPLER (RECOVERY)	CORES				SOL DESCRIPTION OR ROCK LITHOLOGY	SYMBOL	ROCK STRUCTURE	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS		
	RUN NO.	NO. AND SIZE OF CORE PIECES	% RECOVERY	ROD							DEPTH IN FEET		PERMEABILITY CM./SEC.
											FROM	TO	

24 6				SAND, dk-brn, moist		Soil zone							
				SAND f-m, orange-brn moist		brn, moist no odor							
				SAND, f-m, lt orange-		brn, moist, no odor							
				SAND, f, lt orange-									
35 35				SAND, f-m, orange-brn		moist, wet at 9.5							
				fuel odor 8-9.5'		w/c drilled at 9.5							
35 10 8				SAND, f-m, gray		wet fuel odor							
				~ 1/2" silty-clay layer		at 11.5'							
512 14 15				SAA - brn-gray		fuel odor							
				16-16.5 coarse-gr									
				16.5-17 fine-gr									
711 14 19				SAND M-UC, tan		fuel odor							
				tr gravel		TD=20							

CTI  
DRILLING CONTR

RL

LOGGED BY JFH

DATE 9/28/94 CHK'D BY

Figure A.1  
Geologic Boring Log

## LOCATION MAP

Wurtsmith AFB  
OT45

## ENGINEERING-SCIENCE, INC. WELL LOG

PAGE 1 OF 3

WELL NUMBER MW0100

LOCATION OT-45

DATE 10-5-94

WEATHER Sunny 60 °F

LOGGED BY D. Marcelle H.

DRILLED BY CTI

DRILLING METHOD Hollow Stem Auger

SAMPLING METHOD 2-inch split spoon

GRAVEL PACK

SEAL Grout/Bentonite

CASING TYPE Schedule 80 PVC 20

DIAMETER 10-inch

LENGTH 20/59

HOLE DIA. 12 1/16

SCREEN TYPE Schedule 40 PVC 59

DIAMETER 2-inch

LENGTH 10 ft

TOTAL DEPTH 70'

SLOT 10-slot

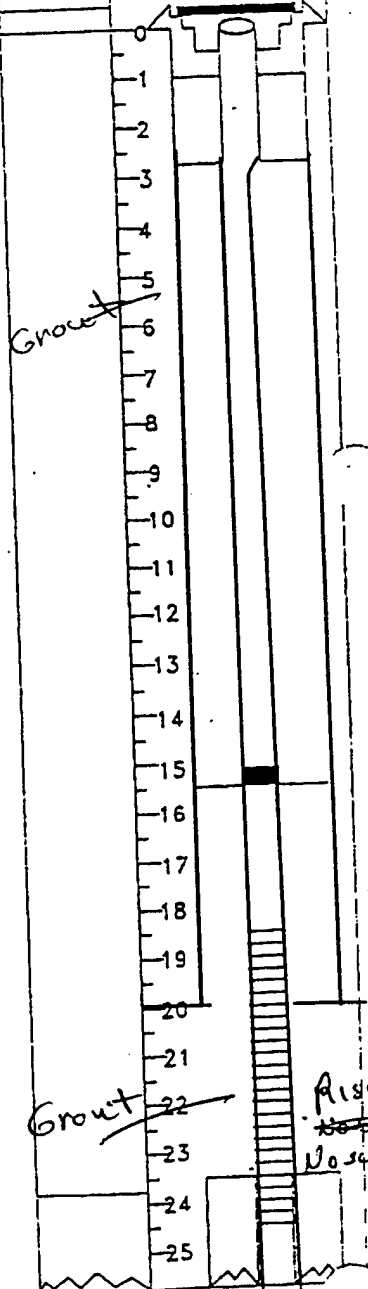
SAMPLE NO.	ORGANIC VAPORS (PPM)	DEPTH	SAMPLE RECOVERY	PENETRATION RESISTANCE
------------	----------------------	-------	-----------------	------------------------

LITHOLOGY/REMARKS  
(COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY)

LITHO. PROFILE

WELL COMPLETION

		0		
		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
		16		
		17		
		18		
		19		
		20		
		21		
		22		
		23		
		24		
		25		

DATE: 10-5-94  
DRAWN BY: [Signature]  
UPDATE # 0

LOCATION MAP		ENGINEERING-SCIENCE, INC. WELL LOG		PAGE 2 OF 3
WELL NUMBER <u>MW0100</u>		LOCATION <u>OT-45</u>		
DATE		WEATHER <u>° F</u>		
LOGGED BY		DRILLED BY		
DRILLING METHOD		SAMPLING METHOD		
GRAVEL PACK		SEAL		

CASING TYPE		DIAMETER		LENGTH		HOLE DIA.		
SCREEN TYPE		SLOT		DIAMETER		LENGTH		
SAMPLE NO.	ORGANIC VAPORS (PPM)	DEPTH	SAMPLE RECOVERY	PENETRATION RESISTANCE	LITHOLOGY/REMARKS (COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY)	LITHO. PROFILE	TOTAL DEPTH	WELL COMPLETION
		25					25	
		26					26	
		27					27	
		28					28	
		29					29	
		30					30	
		31					31	
		32					32	
		33					33	
		34					34	
		35					35	
		36					36	
		37					37	
		38					38	
		39					39	
		40					40	
		41					41	
		42					42	
		43					43	
		44					44	
		45					45	
		46					46	
		47					47	
		48					48	
		49					49	
		50					50	

DATE	DRAWN BY
UPDATE # 0	

← Gravel

← Riser No. 100

LOCATION MAP

## ENGINEERING-SCIENCE, INC. WELL LOG

PAGE 2 OF 3

WELL NUMBER MW0100

LOCATION OT-45

DATE

WEATHER ° F

LOGGED BY

DRILLED BY

DRILLING METHOD

SAMPLING METHOD

GRAVEL PACK

SEAL

CASING TYPE

DIAMETER

LENGTH

HOLE DIA.

SCREEN TYPE

SLOT

DIAMETER

LENGTH

TOTAL DEPTH

SAMPLE NO.

ORGANIC VAPORS (PPM)

DEPTH

SAMPLE RECOVERY

PENETRATION TEST - TANCE

LITHOLOGY/REMARKS  
(COLOR, SOIL, TYPE, SORTING, MOISTURE, PLASTICITY)

LITHO. PROFILE

WELL COMPLETION

25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
505-25  
5-26  
5-27  
5-28  
5-29  
6-30  
6-31  
6-32  
6-33  
6-34  
6-35  
6-36  
6-37  
6-38  
6-39  
7-40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50grou  
sand  
pac

CLEVELAND

J254

DATE

DRAWN BY

UPDATE # 0

FLUSH MOUNT RISER BOX

LOCKABLE CAP

GROUND SURFACE  
(618.09' MSL)

TOC (617.94' MSL)

BENTONITE

2" DIA. SCH. 40 PVC  
SURFACE CASING

9.0

10.0

15.0

15.0

SAND

2" DIA. SCH. 40 PVC SCREEN  
W/THREADED JOINTS  
SLOT SIZE = 0.010"

8" DIA. BOREHOLE

END CAP

**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW4-OT45**

SITE: OT45

GEOLOGIST: JFH

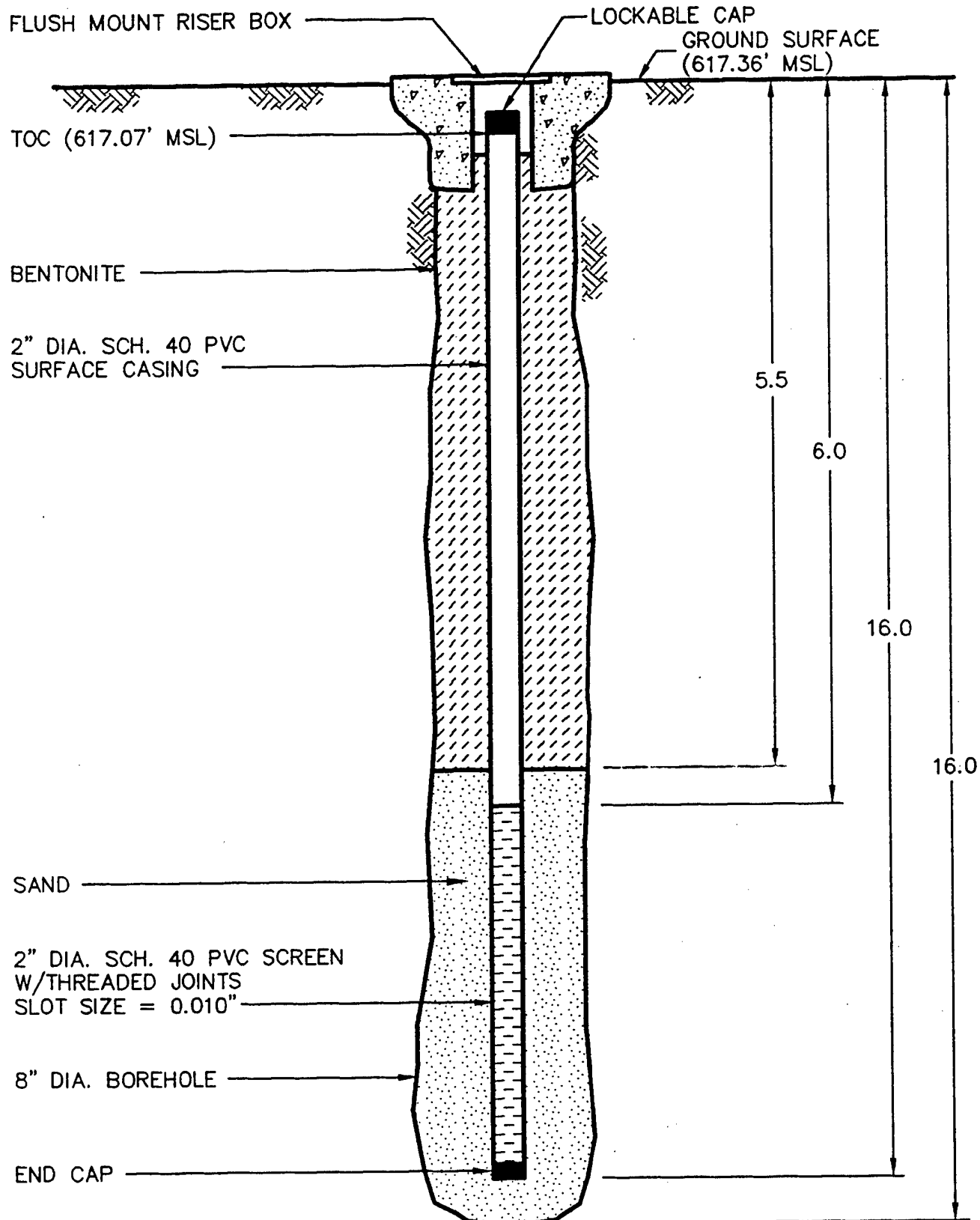
DATE COMPLETED: 09/29/94

WURTSMITH AFB, MI



**PARSONS  
ENGINEERING SCIENCE, INC.**

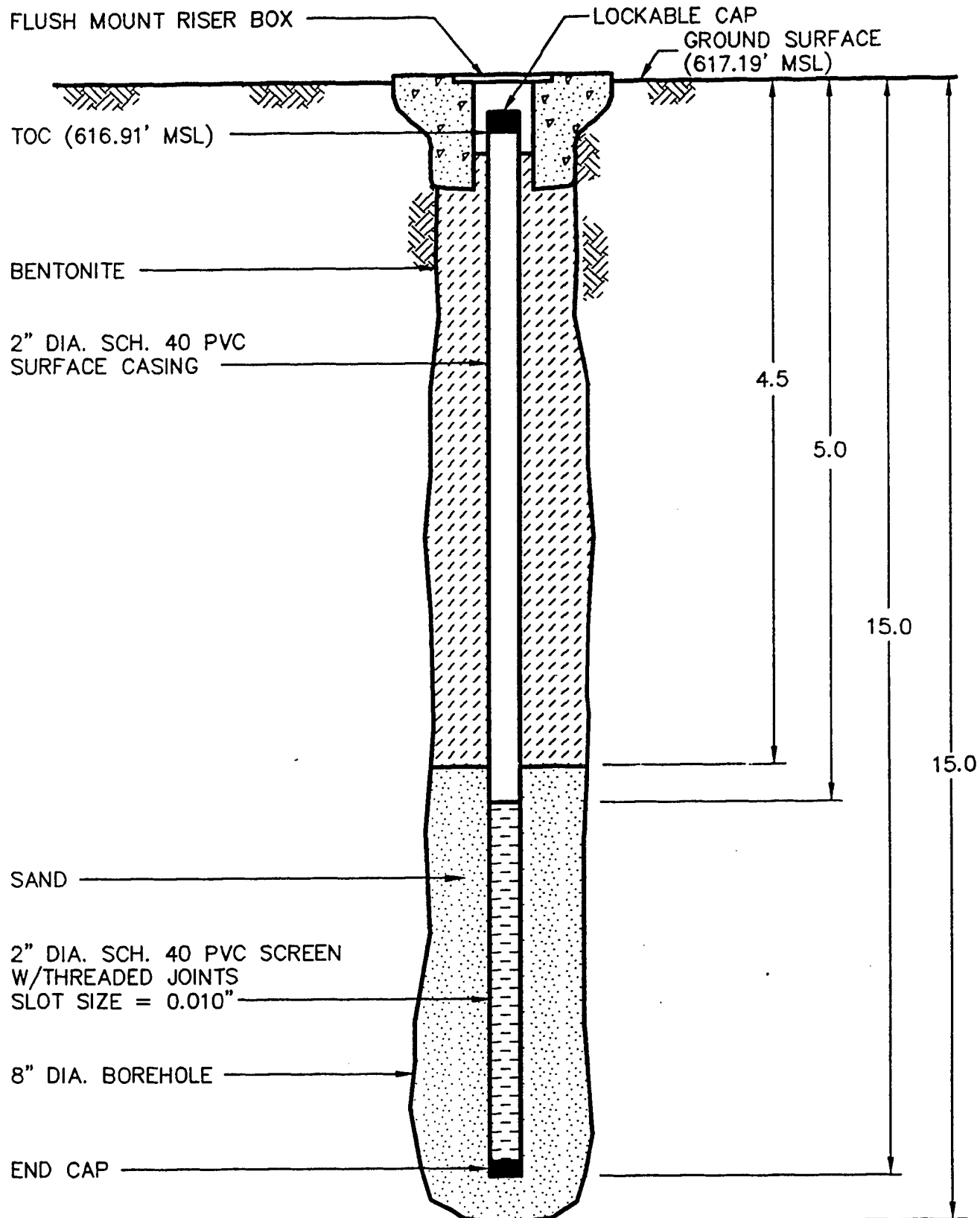




**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW5**

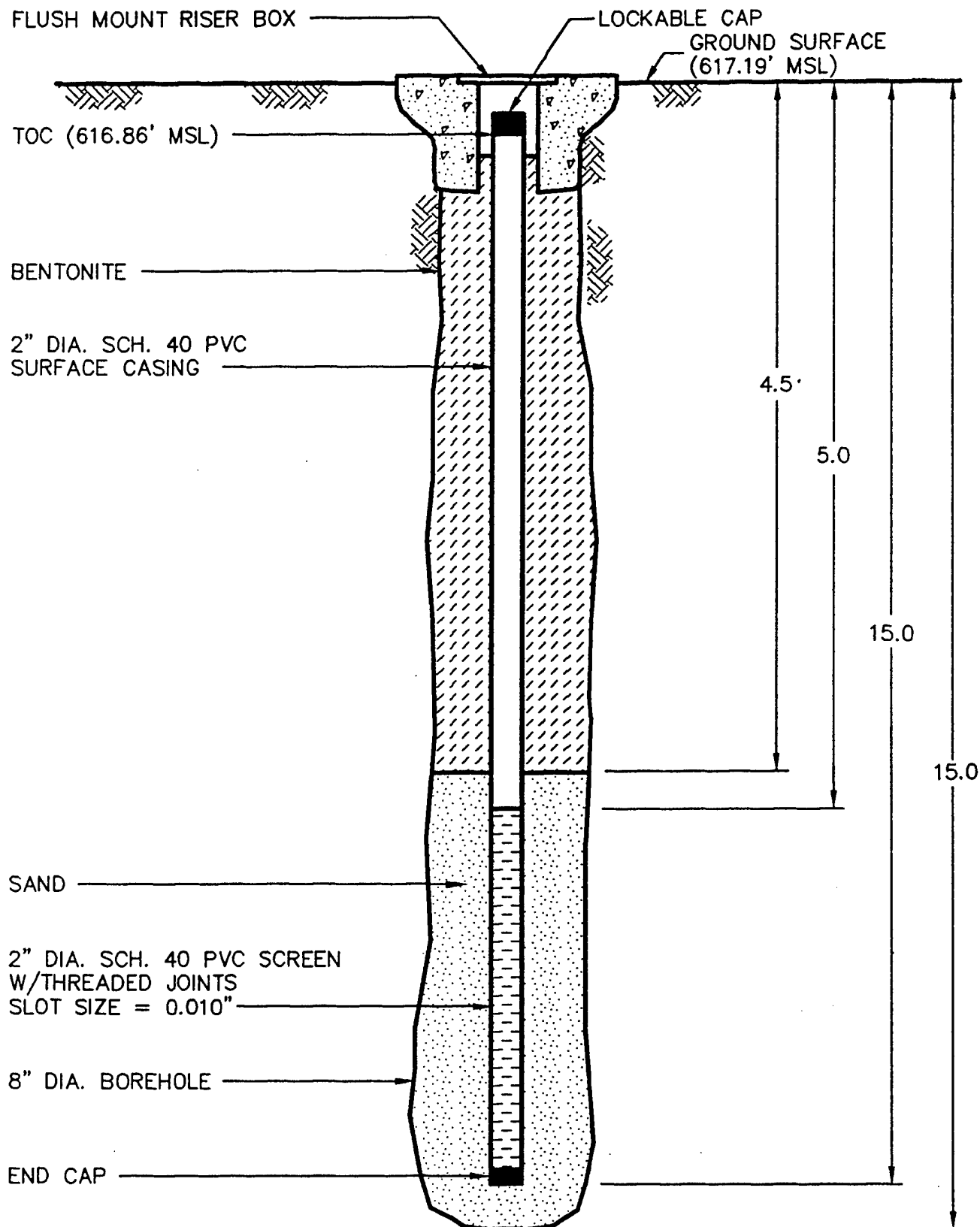
SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/29/94  
WURTSMITH AFB, MI

**PARSONS  
ENGINEERING SCIENCE, INC.**



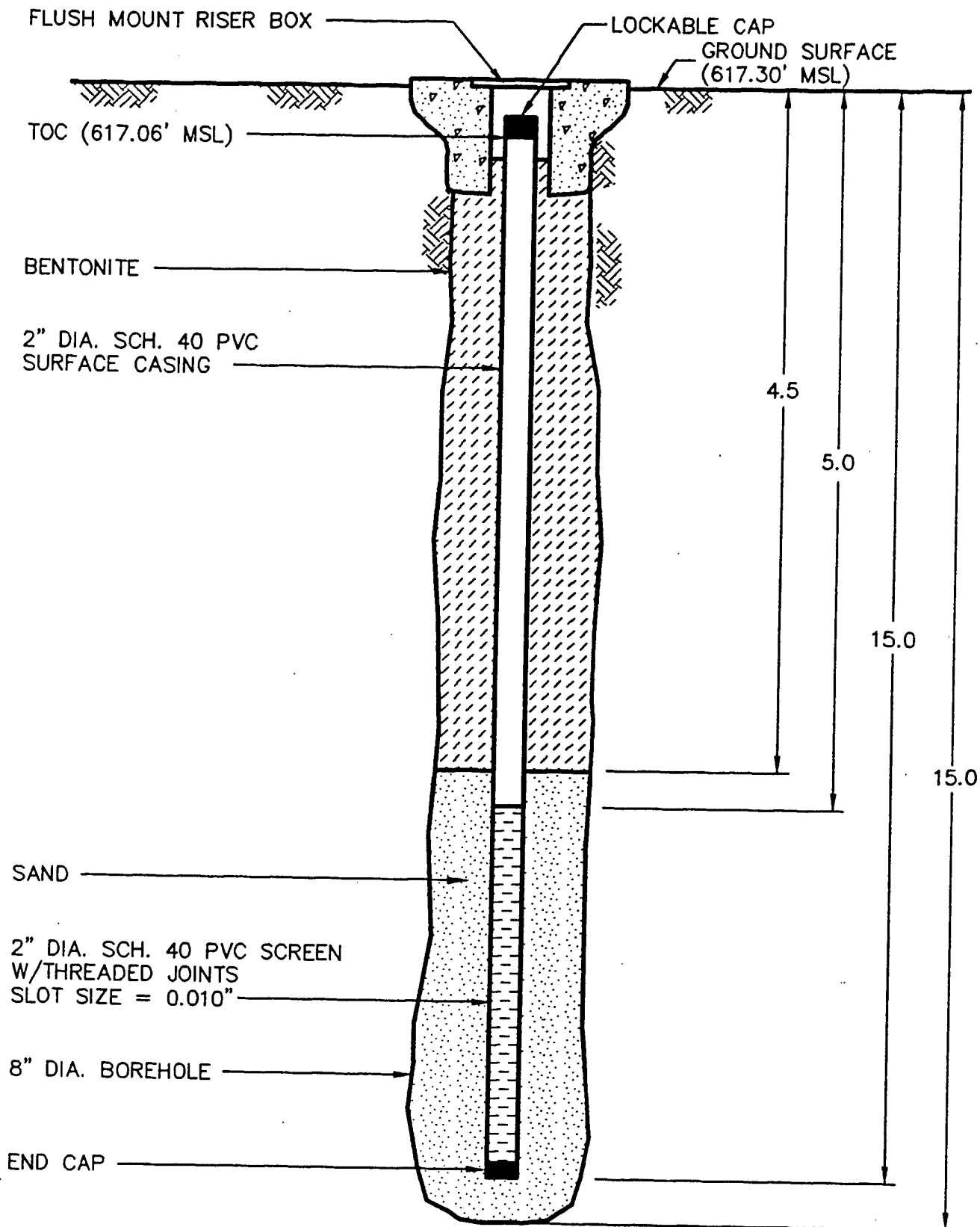
**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW6**

SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI



**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW7**

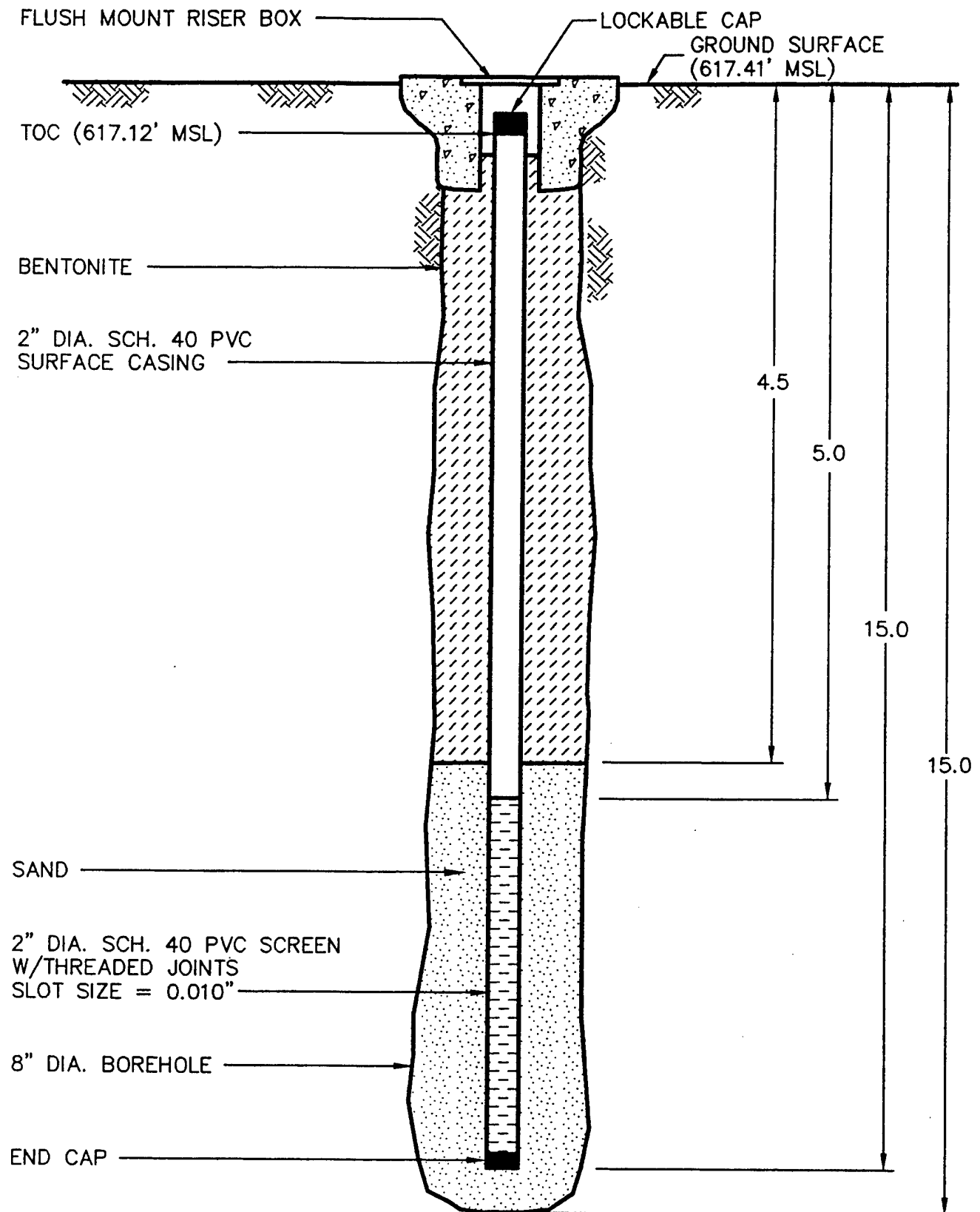
SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI



**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW8**

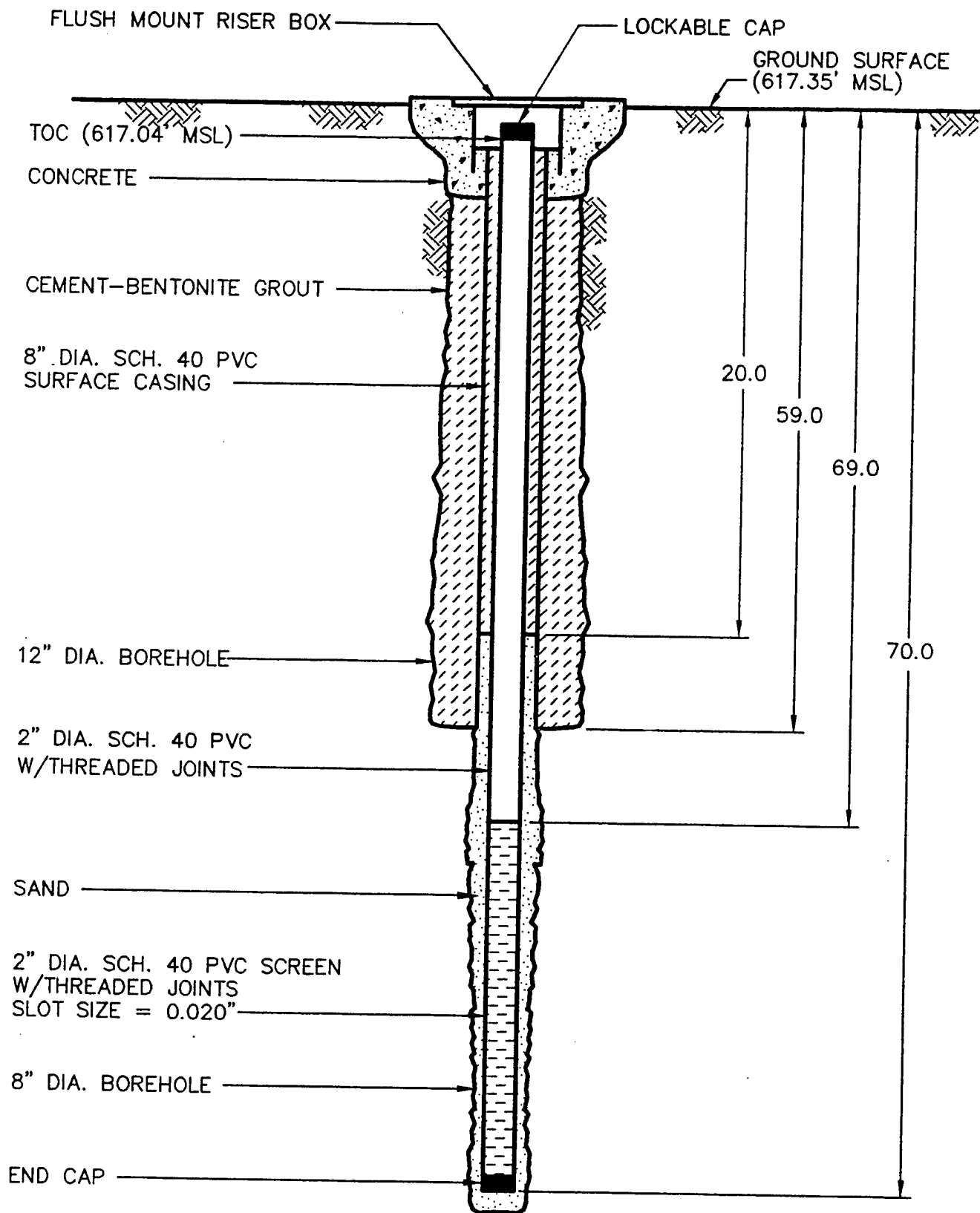
SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI

**PARSONS  
ENGINEERING SCIENCE, INC.**



**FLUSH-MOUNTED  
MONITORING WELL DESIGN DETAIL  
WELL NO. MW9**

SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/29/94  
WURTSMITH AFB, MI



# MONITORING WELL DESIGN DETAIL WELL NO. MW10

SITE: OT45

GEOLOGIST: NM

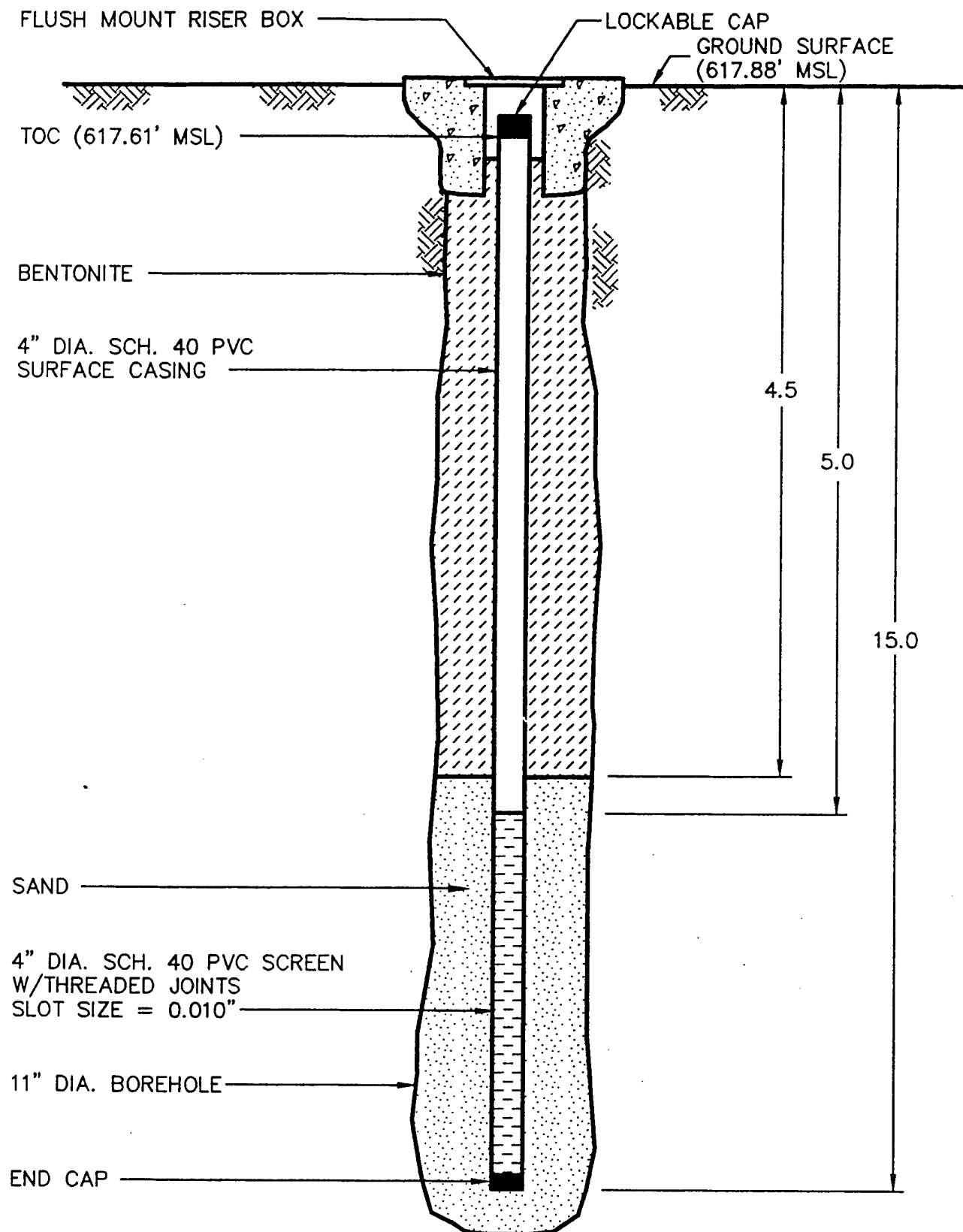
DATE COMPLETED: 10/05/94

WURTSMITH AFB, MI



**PARSONS  
ENGINEERING SCIENCE, INC.**

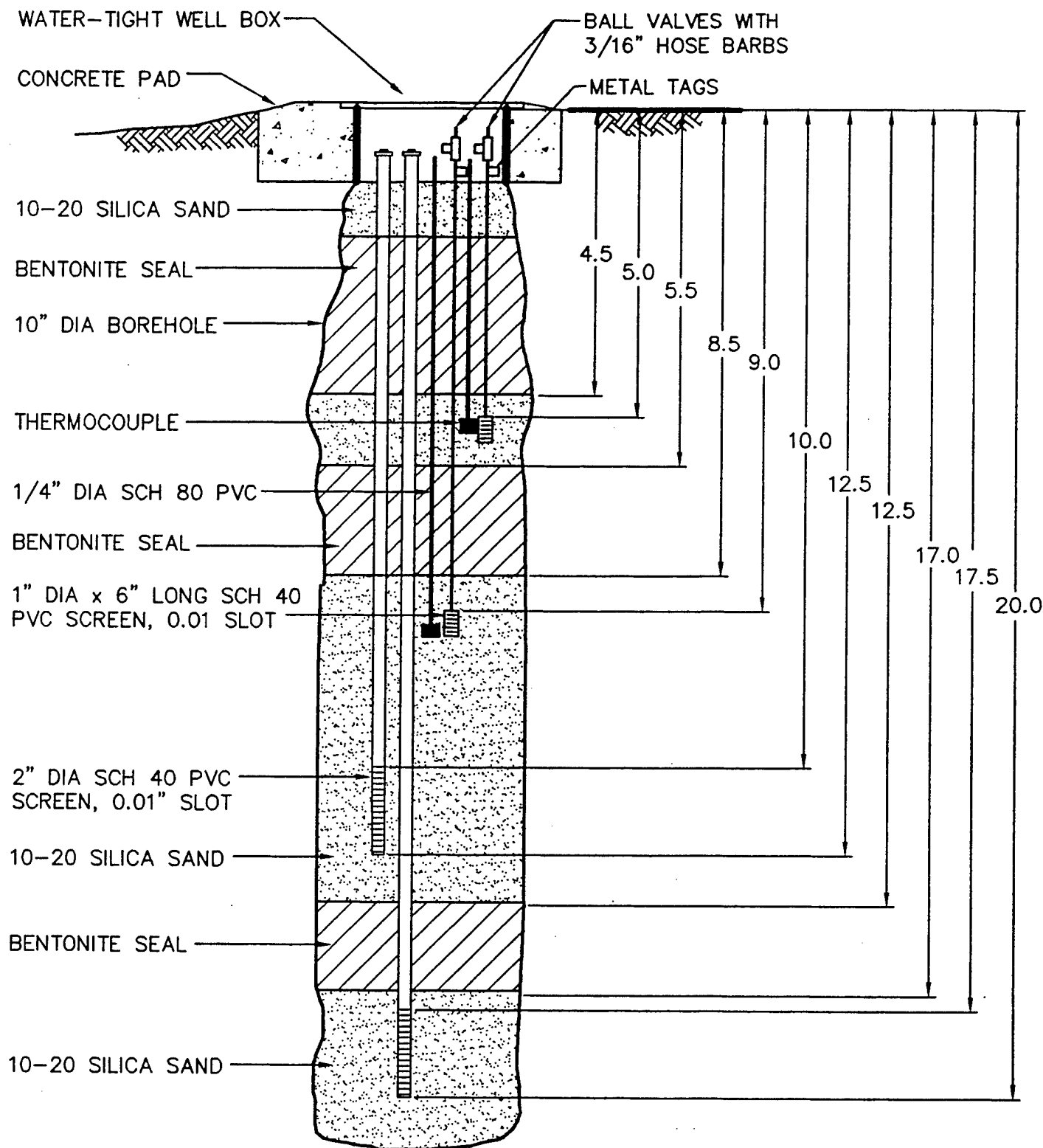




**FLUSH-MOUNTED  
VENT WELL DESIGN DETAIL  
WELL NO. VW-1**

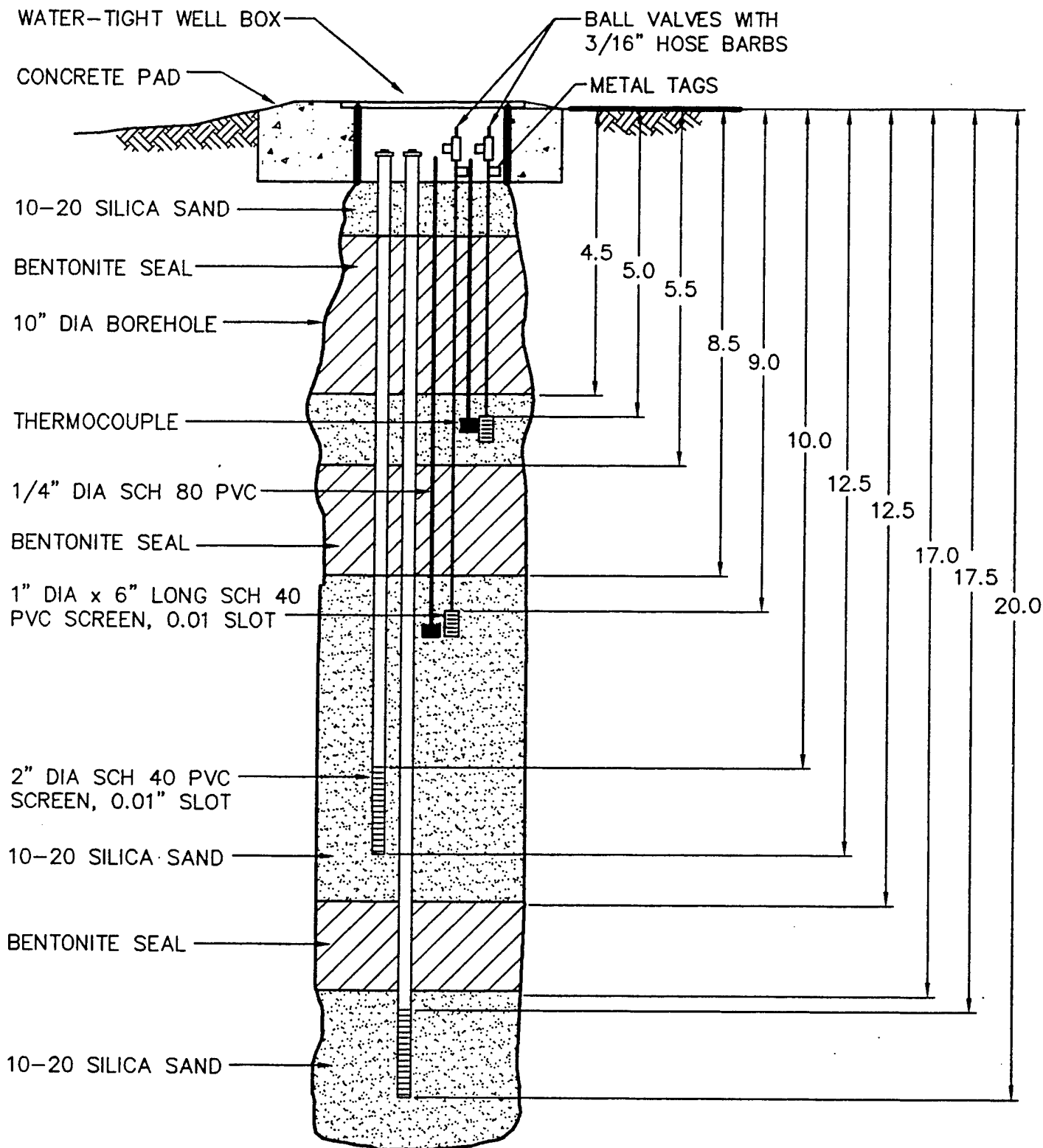
SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI





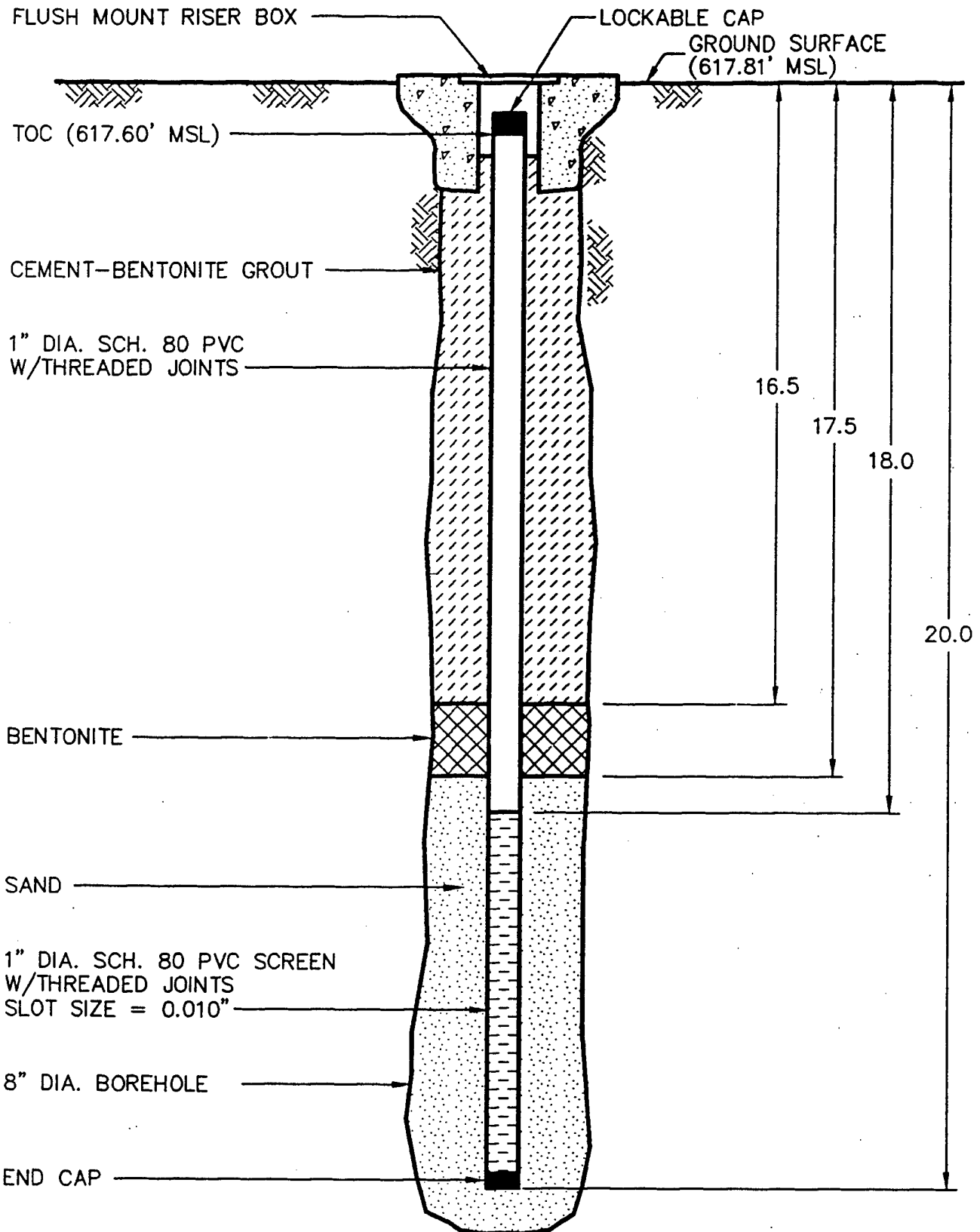
**MONITORING POINT  
CONSTRUCTION DETAIL  
WELL NO. MPA**

SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI



**MONITORING POINT  
CONSTRUCTION DETAIL  
WELL NO. MPB**

SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 09/28/94  
WURTSMITH AFB, MI



**FLUSH-MOUNTED  
AIR SPARGING WELL DESIGN DETAIL  
WELL NO. SP1**

SITE: OT45  
GEOLOGIST: JFH  
DATE COMPLETED: 10/04/94  
WURTSMITH AFB, MI

**PARSONS  
ENGINEERING SCIENCE, INC.**

# WELL DEVELOPMENT RECORD

Well Designation VW1-0T45 Developed By J. Hall Date 9/30/94

Time Started 13:20 Time Ended 13:40

**Development Method:**

BAIL   X   PUMP   X   SURGE   X   AIR LIFT       

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start)						
2 gal	62.8	7.22	348			
10 gal	61.0	7.64	269			
20	57.8	7.66	255			
30	58.8	7.70	241			
(Finish)						

**Comments:**

Strong shear + diesel oil oder

# WELL DEVELOPMENT RECORD

Well Designation MPA-UT45S Developed By J. Hall Date 9/30/94

Time Started 13:00 Time Ended 13:10

**Development Method:**

BAIL            PUMP            SURGE            AIR LIFT           

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 2 gal	68.0	7.70	380			V. cloudy
10 gal	63.9	7.72	383			
12 gal	62.5	7.84	393			Slightly cloudy
(Finish)						

**Comments:**

Sheen on water surface, diesel odor.

# WELL DEVELOPMENT RECORD

Well Designation MPA-0T45D Developed By J. Hall Date 9/30/94

Time Started 13:10 Time Ended 13:20

**Development Method:**

BAIL + PUMP + SURGE + AIR LIFT +

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 2 gal	61.0	8.10	200			
10 gal	57.0	8.17	170			
15 gal	55.8	8.21	168			
(Finish)						

**Comments:**

no noticeable stain or odor

# WELL DEVELOPMENT RECORD

Well Designation MPB-0T45 S Developed By J. Hall Date 9/30/94

Time Started 11:30 Time Ended 12:00

**Development Method:**

BAIL \_\_\_\_\_ PUMP \_\_\_\_\_ SURGE \_\_\_\_\_ AIR LIFT \_\_\_\_\_

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start)						
2 gal	64.0	6.80	330			
10	60.9	6.30	452			
		7.09*	41			
20	59.6	7.50	418			
(Finish)						

Comments:

Comments: Sheen on water dose  
\* re-calibrated pH meter - oil odor

# WELL DEVELOPMENT RECORD

Well Designation MPB-0745 D Developed By \_\_\_\_\_ Date 7/31/99

Time Started 12:00 Time Ended 12:20

**Development Method:**

BAIL + PUMP + SURGE 1 AIR LIFT       

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start)						
2ga'	59.6	7.25	248			dodgy
40	61.0	7.75	235			clear
(Finish)						

**Comments:**

re-calibrated pH meter,  
no shown



# WELL DEVELOPMENT RECORD

Well Designation MW4-OT45 Developed By J. Hall Date 9/30/98

Time Started 09:30 Time Ended 09:45

W/L 10.3 15.1 TD TOC

**Development Method:**

BAIL 7 PUMP + SURGE + AIR LIFT       

OTHER (SPECIFY) 04:28

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 25 gal	53.5	7.20	211			v.c cloudy
30	53.8	7.26	238			c cloudy
35	54.5	7.36	250			
40	54.8	7.25	254			s.l. c cloudy
42	54.8	7.27	255			v.s.l cloudy
(Finish)						

**Comments:**

# WELL DEVELOPMENT RECORD

Well Designation MW5-0T45 Developed By J. Hall Date 9/30/84

Time Started 10:50 Time Ended 11:20

WL 9.63 TD 15.70 TUC

**Development Method:**

BAIL ✓ PUMP ✓ SURGE ✓ AIR LIFT \_\_\_\_\_

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 5 gal	54.9	7.39	270			V-Cloudy
30	50.8	7.15	260			sl cloudy
45	54.6	6.95	268			sl cloudy
(Finish)						

Comments:

oil on water  
film

# WELL DEVELOPMENT RECORD

Well Designation MW6 Developed By JFH/11 Date 9/30/94

Time Started 0840 Time Ended 09:10  
WL 9.73 TD 14.60 TOC

**Development Method:**

BAIL   X   PUMP   X   SURGE            AIR LIFT           

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start)						
2 gal	43	8.40	189			Muddy
18	49.2	8.96	106			V. cloudy
25	52.8	8.75	175			cloudy
37	53.7	7.40*	179			"
45	54.2	7.28	173			Slight cloudy
(Finish)						

**Comments:**

\* re-calibrated pH - tends to increase w ↑ temp

Figure A.6  
Well Development Record

Page 1 of 1

Job Number 725523  
Location OT45  
Well Number MW 8

Job Name W. J. Smith  
By JFH Date 7/30/94  
Measurement Datum TOC

Pre-Development Information

Time (Start):

Water Level: 9.87

Total Depth of Well: 14.45

Water Characteristics

Color \_\_\_\_\_ Clear \_\_\_\_\_ Cloudy \_\_\_\_\_  
Odor: None \_\_\_\_\_ Weak \_\_\_\_\_ Moderate \_\_\_\_\_ Strong \_\_\_\_\_  
Any Films or Immiscible Material \_\_\_\_\_  
pH \_\_\_\_\_ Temperature (°F °C) \_\_\_\_\_  
Specific Conductance (µS/cm) \_\_\_\_\_

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance (µS/cm)

Post-Development Information

Time (Finish):

Water Level:

Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color \_\_\_\_\_ Clear \_\_\_\_\_ Cloudy \_\_\_\_\_  
Odor: None \_\_\_\_\_ Weak \_\_\_\_\_ Moderate \_\_\_\_\_ Strong \_\_\_\_\_  
Any Films or Immiscible Material \_\_\_\_\_  
pH \_\_\_\_\_ Temperature (°F °C) \_\_\_\_\_  
Specific Conductance (µS/cm) \_\_\_\_\_

Comments:

# WELL DEVELOPMENT RECORD

Well Designation MWB-OT45 Developed By \_\_\_\_\_ Date 9/30/44

Time Started \_\_\_\_\_ Time Ended \_\_\_\_\_

Development Method:

BAIL \_\_\_\_\_ PUMP alt pump X blow air SURGE \_\_\_\_\_ AIR LIFT \_\_\_\_\_

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 2 gal	41.5	7.13	300	muddy		Muddy
8 gal	48.5	7.40	314			"
15	51.7	7.51	311			31 cloudy
25	51.2	7.65	310			
30	51.6	7.63	310			
(Finish)						

Comments: \_\_\_\_\_

# WELL DEVELOPMENT RECORD

Well Designation MW9-0745 Developed By J. Hall Date 9/30/94

Time Started 10:00

Time Ended 10:30

WL 9.70 TD 14.50

**Development Method:**

BAIL       X       PUMP       X       SURGE       X       AIR LIFT       

OTHER (SPECIFY) \_\_\_\_\_

Casing Volume \_\_\_\_\_ Approximate Volume Removed \_\_\_\_\_

TIME/ BAILER NO.	TEMPERATURE	pH	ELECTRICAL CONDUCTIVITY	TURBIDITY	HNU	VISUAL APPEARANCE
(Start) 2gal	55.5	7.45	299			Muddy
10	55.9	7.67	285			cloudy
15	57.31	7.65	285			
25	57.8	7.74	283			
47	56.1	7.85	268			
(Finish)						

**Comments:**

**Figure A.6**  
**Well Development Record**

Page    of   

Job Number                       
Location                       
Well Number MW11-0745

Job Name                       
By                      Date 10/6/94  
Measurement Datum                     

Pre-Development Information

Time (Start): 11:50

Water Level: 9.87

Total Depth of Well: 14.55

Water Characteristics

Color brn Clear Cloudy  
Odor: None Weak Moderate Strong  
Any Films or Immiscible Material No  
pH                      Temperature (°F °C)                       
Specific Conductance (μS/cm)                     

Interim Water Characteristics

Gallons Removed	5	20	30	35
pH	9.04	9.04	8.95	8.65
Temperature (°F °C)	58.4	58.1	57.2	56.9
Specific Conductance (μS/cm)	270	301	298	302

Post-Development Information

Time (Finish):                     

Water Level: 9.87

Total Depth of Well: 14.60

Approximate Volume Removed: 35 gal

Water Characteristics

Color brn sl cloudy Clear Cloudy  
Odor: None Weak Moderate Strong  
Any Films or Immiscible Material No  
pH 8.65 Temperature (°F °C) 56.9  
Specific Conductance (μS/cm) 302

Comments:

**APPENDIX B**  
**ANALYTICAL DATA**



**TABLE B.1**  
**VALIDATED SOIL DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
DC-OT45 (MW2)	28-Sep-94	12.00 - 15.00	Total Extractable Hydrocarbons	550 J <sup>h</sup>	mg/kg	M8015
			Benzene	2.3 U <sup>h</sup>	µg/kg	SW8020
			Toluene	23 U	µg/kg	SW8020
			Ethylbenzene	6.9 J	µg/kg	SW8020
			Xylenes (Total)	30	µg/kg	SW8020
			1,3,5-Trimethylbenzene	160	µg/kg	SW8020
			1,2,4-Trimethylbenzene	240	µg/kg	SW8020
			1,2,3-Trimethylbenzene	240	µg/kg	SW8020
MPA-OT45	28-Sep-94	8.00 - 9.50	Total Extractable Hydrocarbons	100 UJ <sup>h</sup>	mg/kg	M8015
			Benzene	0.46 U	µg/kg	SW8020
			Toluene	0.5 J	µg/kg	SW8020
			Ethylbenzene	4.6 U	µg/kg	SW8020
			Xylenes (Total)	4.6 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.6 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.6 U	µg/kg	SW8020
MPB-OT45	28-Sep-94	8.00 - 9.50	Total Extractable Hydrocarbons	12000 J	mg/kg	M8015
			Benzene	2.2 U	µg/kg	SW8020
			Toluene	22 U	µg/kg	SW8020
			Ethylbenzene	8.2 J	µg/kg	SW8020
			Xylenes (Total)	25	µg/kg	SW8020
			1,3,5-Trimethylbenzene	390	µg/kg	SW8020
			1,2,4-Trimethylbenzene	900	µg/kg	SW8020
			1,2,3-Trimethylbenzene	540	µg/kg	SW8020
MW4-OT45	29-Sep-94	8.00 - 9.50	Benzene	0.48 U	µg/kg	SW8020
			Toluene	4.8 U	µg/kg	SW8020
			Ethylbenzene	4.8 U	µg/kg	SW8020
			Xylenes (Total)	4.8 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.8 U	µg/kg	SW8020
MW5-OT45	29-Sep-94	10.00 - 13.00	Benzene	2.3 U	µg/kg	SW8020
			Toluene	31	µg/kg	SW8020
			Ethylbenzene	160	µg/kg	SW8020
			Xylenes (Total)	890	µg/kg	SW8020
			1,3,5-Trimethylbenzene	1300 J	µg/kg	SW8020
			1,2,4-Trimethylbenzene	2200 J	µg/kg	SW8020
			1,2,3-Trimethylbenzene	1400 J	µg/kg	SW8020
MW6-OT45	29-Sep-94	8.00 - 9.50	Benzene	0.49 U	µg/kg	SW8020
			Toluene	4.9 U	µg/kg	SW8020
			Ethylbenzene	4.9 U	µg/kg	SW8020
			Xylenes (Total)	4.9 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.9 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.9 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.9 U	µg/kg	SW8020
MW7-OT45	27-Sep-94	8.00 - 9.00	Total Extractable Hydrocarbons	35 J	mg/kg	M8015
			Benzene	0.47 UJ	µg/kg	SW8020
			Toluene	4.7 UJ	µg/kg	SW8020
			Ethylbenzene	4.7 UJ	µg/kg	SW8020
			Xylenes (Total)	4.7 UJ	µg/kg	SW8020
			1,3,5-Trimethylbenzene	0.9 J	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.7 UJ	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.7 UJ	µg/kg	SW8020
MW8-OT45	29-Sep-94	8.00 - 9.50	Benzene	0.48 U	µg/kg	SW8020
			Toluene	4.8 U	µg/kg	SW8020
			Ethylbenzene	4.8 U	µg/kg	SW8020
			Xylenes (Total)	4.8 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.8 U	µg/kg	SW8020

**TABLE B.1**  
**VALIDATED SOIL DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
MW9-OT45	29-Sep-94	8.00 - 9.50	Benzene	0.47 U	µg/kg	SW8020
			Toluene	4.7 U	µg/kg	SW8020
			Ethylbenzene	4.7 U	µg/kg	SW8020
			Xylenes (Total)	4.7 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.7 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	0.7 J	µg/kg	SW8020
			1,2,3-Trimethylbenzene	0.5 J	µg/kg	SW8020
MW10-OT45	3-Oct-94	9.00 - 11.00	Benzene	0.46 U	µg/kg	SW8020
			Toluene	4.6 U	µg/kg	SW8020
			Ethylbenzene	4.6 U	µg/kg	SW8020
			Xylenes (Total)	4.6 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.6 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.6 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.6 U	µg/kg	SW8020
MW11-OT45	6-Oct-94	10.00 - 12.00	Benzene	0.48 U	µg/kg	SW8020
			Toluene	4.8 U	µg/kg	SW8020
			Ethylbenzene	4.8 U	µg/kg	SW8020
			Xylenes (Total)	4.8 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.8 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.8 U	µg/kg	SW8020
VW1-OT45	28-Sep-94	8.00 - 9.50	Total Extractable Hydrocarbons	45 J	mg/kg	M8015
			Benzene	0.45 U	µg/kg	SW8020
			Toluene	4.5 U	µg/kg	SW8020
			Ethylbenzene	4.5 U	µg/kg	SW8020
			Xylenes (Total)	4.5 U	µg/kg	SW8020
			1,3,5-Trimethylbenzene	0.7 J	µg/kg	SW8020
			1,2,4-Trimethylbenzene	4.5 U	µg/kg	SW8020
			1,2,3-Trimethylbenzene	4.5 U	µg/kg	SW8020

" J= estimated value

" U= analyte not detected above method detection limit

" UJ=estimated concentration of analyte not detected above method detection limit

**TABLE B.2**  
**VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
DC-OT45 (MW2)	28-Sep-94	12.00 - 15.00	Naphthalene	790	µg/kg	SW8270
			2-Methylnaphthalene	380 U <sup>a</sup>	µg/kg	SW8270
			Acenaphthylene	380 U	µg/kg	SW8270
			Acenaphthene	220 J <sup>a</sup>	µg/kg	SW8270
			Dibenzofuran	110 J	µg/kg	SW8270
			Fluorene	310 J	µg/kg	SW8270
			Phenanthrene	380 U	µg/kg	SW8270
			Anthracene	380 U	µg/kg	SW8270
			Fluoranthene	380 U	µg/kg	SW8270
			Pyrene	45 J	µg/kg	SW8270
			Benzo(a)anthracene	380 U	µg/kg	SW8270
			Chrysene	380 U	µg/kg	SW8270
			Benzo(b)fluoranthene	380 U	µg/kg	SW8270
			Benzo(k)fluoranthene	380 U	µg/kg	SW8270
			Benzo(a)pyrene	380 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	380 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	380 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	380 U	µg/kg	SW8270
MPA-OT45	28-Sep-94	8.00 - 9.50	Naphthalene	370 U	µg/kg	SW8270
			2-Methylnaphthalene	370 U	µg/kg	SW8270
			Acenaphthylene	370 U	µg/kg	SW8270
			Acenaphthene	370 U	µg/kg	SW8270
			Dibenzofuran	370 U	µg/kg	SW8270
			Fluorene	370 U	µg/kg	SW8270
			Phenanthrene	370 U	µg/kg	SW8270
			Anthracene	370 U	µg/kg	SW8270
			Fluoranthene	370 U	µg/kg	SW8270
			Pyrene	370 U	µg/kg	SW8270
			Benzo(a)anthracene	370 U	µg/kg	SW8270
			Chrysene	370 U	µg/kg	SW8270
			Benzo(b)fluoranthene	370 U	µg/kg	SW8270
			Benzo(k)fluoranthene	370 U	µg/kg	SW8270
			Benzo(a)pyrene	370 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	370 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	370 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	370 U	µg/kg	SW8270
MPB-OT45	28-Sep-94	8.00 - 9.50	Naphthalene	330 U	µg/kg	SW8270
			2-Methylnaphthalene	330 U	µg/kg	SW8270
			Acenaphthylene	330 U	µg/kg	SW8270
			Acenaphthene	330 U	µg/kg	SW8270
			Dibenzofuran	330 U	µg/kg	SW8270
			Fluorene	330 U	µg/kg	SW8270
			Phenanthrene	330 U	µg/kg	SW8270
			Anthracene	330 U	µg/kg	SW8270
			Fluoranthene	330 U	µg/kg	SW8270
			Pyrene	180 J	µg/kg	SW8270
			Benzo(a)anthracene	330 U	µg/kg	SW8270
			Chrysene	330 U	µg/kg	SW8270
			Benzo(b)fluoranthene	330 U	µg/kg	SW8270
			Benzo(k)fluoranthene	330 U	µg/kg	SW8270
			Benzo(a)pyrene	330 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	330 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	330 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	330 U	µg/kg	SW8270
MW4-OT45	29-Sep-94	8.00 - 9.50	Naphthalene	350 U	µg/kg	SW8270

**TABLE B.2**  
**VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
MW4-OT45	29-Sep-94	8.00 - 9.50	2-Methylnaphthalene	350 U	µg/kg	SW8270
			Acenaphthylene	350 U	µg/kg	SW8270
			Acenaphthene	350 U	µg/kg	SW8270
			Dibenzofuran	350 U	µg/kg	SW8270
			Fluorene	350 U	µg/kg	SW8270
			Phenanthrene	350 U	µg/kg	SW8270
			Anthracene	350 U	µg/kg	SW8270
			Fluoranthene	350 U	µg/kg	SW8270
			Pyrene	350 U	µg/kg	SW8270
			Benzo(a)anthracene	350 U	µg/kg	SW8270
			Chrysene	350 U	µg/kg	SW8270
			Benzo(b)fluoranthene	350 U	µg/kg	SW8270
			Benzo(k)fluoranthene	350 U	µg/kg	SW8270
			Benzo(a)pyrene	350 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	350 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	350 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	350 U	µg/kg	SW8270
MW5-OT45	29-Sep-94	10.00 - 13.00	Naphthalene	1400	µg/kg	SW8270
			2-Methylnaphthalene	7000	µg/kg	SW8270
			Acenaphthylene	390 U	µg/kg	SW8270
			Acenaphthene	380 J	µg/kg	SW8270
			Dibenzofuran	390 U	µg/kg	SW8270
			Fluorene	550	µg/kg	SW8270
			Phenanthrene	1600	µg/kg	SW8270
			Anthracene	390 U	µg/kg	SW8270
			Fluoranthene	390 U	µg/kg	SW8270
			Pyrene	51 J	µg/kg	SW8270
			Benzo(a)anthracene	390 U	µg/kg	SW8270
			Chrysene	390 U	µg/kg	SW8270
			Benzo(b)fluoranthene	390 U	µg/kg	SW8270
			Benzo(k)fluoranthene	390 U	µg/kg	SW8270
			Benzo(a)pyrene	390 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	390 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	390 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	390 U	µg/kg	SW8270
MW6-OT45	29-Sep-94	8.00 - 9.50	Naphthalene	410 U	µg/kg	SW8270
			2-Methylnaphthalene	410 U	µg/kg	SW8270
			Acenaphthylene	410 U	µg/kg	SW8270
			Acenaphthene	410 U	µg/kg	SW8270
			Dibenzofuran	410 U	µg/kg	SW8270
			Fluorene	410 U	µg/kg	SW8270
			Phenanthrene	410 U	µg/kg	SW8270
			Anthracene	410 U	µg/kg	SW8270
			Fluoranthene	410 U	µg/kg	SW8270
			Pyrene	410 U	µg/kg	SW8270
			Benzo(a)anthracene	410 U	µg/kg	SW8270
			Chrysene	410 U	µg/kg	SW8270
			Benzo(b)fluoranthene	410 U	µg/kg	SW8270
			Benzo(k)fluoranthene	410 U	µg/kg	SW8270
			Benzo(a)pyrene	410 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	410 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	410 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	410 U	µg/kg	SW8270
MW7-OT45	27-Sep-94	8.00 - 9.00	Naphthalene	330 U	µg/kg	SW8270
			2-Methylnaphthalene	330 U	µg/kg	SW8270

**TABLE B.2**  
**VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
MW7-OT45	27-Sep-94	8.00 - 9.00	Acenaphthylene	330 U	µg/kg	SW8270
			Acenaphthene	330 U	µg/kg	SW8270
			Dibenzofuran	330 U	µg/kg	SW8270
			Fluorene	330 U	µg/kg	SW8270
			Phenanthrene	330 U	µg/kg	SW8270
			Anthracene	330 U	µg/kg	SW8270
			Fluoranthene	330 U	µg/kg	SW8270
			Pyrene	330 U	µg/kg	SW8270
			Benzo(a)anthracene	330 U	µg/kg	SW8270
			Chrysene	330 U	µg/kg	SW8270
			Benzo(b)fluoranthene	330 U	µg/kg	SW8270
			Benzo(k)fluoranthene	330 U	µg/kg	SW8270
			Benzo(a)pyrene	330 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	330 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	330 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	330 U	µg/kg	SW8270
MW8-OT45	29-Sep-94	8.00 - 9.50	Naphthalene	400 U	µg/kg	SW8270
			2-Methylnaphthalene	400 U	µg/kg	SW8270
			Acenaphthylene	400 U	µg/kg	SW8270
			Acenaphthene	400 U	µg/kg	SW8270
			Dibenzofuran	400 U	µg/kg	SW8270
			Fluorene	400 U	µg/kg	SW8270
			Phenanthrene	400 U	µg/kg	SW8270
			Anthracene	400 U	µg/kg	SW8270
			Fluoranthene	400 U	µg/kg	SW8270
			Pyrene	400 U	µg/kg	SW8270
			Benzo(a)anthracene	400 U	µg/kg	SW8270
			Chrysene	400 U	µg/kg	SW8270
			Benzo(b)fluoranthene	400 U	µg/kg	SW8270
			Benzo(k)fluoranthene	400 U	µg/kg	SW8270
			Benzo(a)pyrene	400 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	400 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	400 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	400 U	µg/kg	SW8270
MW9-OT45	29-Sep-94	8.00 - 9.50	Naphthalene	380 U	µg/kg	SW8270
			2-Methylnaphthalene	380 U	µg/kg	SW8270
			Acenaphthylene	380 U	µg/kg	SW8270
			Acenaphthene	380 U	µg/kg	SW8270
			Dibenzofuran	380 U	µg/kg	SW8270
			Fluorene	380 U	µg/kg	SW8270
			Phenanthrene	380 U	µg/kg	SW8270
			Anthracene	380 U	µg/kg	SW8270
			Fluoranthene	380 U	µg/kg	SW8270
			Pyrene	380 U	µg/kg	SW8270
			Benzo(a)anthracene	380 U	µg/kg	SW8270
			Chrysene	380 U	µg/kg	SW8270
			Benzo(b)fluoranthene	380 U	µg/kg	SW8270
			Benzo(k)fluoranthene	380 U	µg/kg	SW8270
			Benzo(a)pyrene	380 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	380 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	380 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	380 U	µg/kg	SW8270
MW10-OT45	3-Oct-94	9.00 - 11.00	Naphthalene	380 U	µg/kg	SW8270
			2-Methylnaphthalene	380 U	µg/kg	SW8270
			Acenaphthylene	380 U	µg/kg	SW8270

**TABLE B.2**  
**VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
MW10-OT45	3-Oct-94	9.00 - 11.00	Acenaphthene	380 U	µg/kg	SW8270
			Dibenzofuran	380 U	µg/kg	SW8270
			Fluorene	380 U	µg/kg	SW8270
			Phenanthrene	380 U	µg/kg	SW8270
			Anthracene	380 U	µg/kg	SW8270
			Fluoranthene	380 U	µg/kg	SW8270
			Pyrene	380 U	µg/kg	SW8270
			Benzo(a)anthracene	380 U	µg/kg	SW8270
			Chrysene	380 U	µg/kg	SW8270
			Benzo(b)fluoranthene	380 U	µg/kg	SW8270
			Benzo(k)fluoranthene	380 U	µg/kg	SW8270
			Benzo(a)pyrene	380 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	380 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	380 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	380 U	µg/kg	SW8270
MW11-OT45	6-Oct-94	10.00 - 12.00	Naphthalene	360 U	µg/kg	SW8270
			2-Methylnaphthalene	360 U	µg/kg	SW8270
			Acenaphthylene	360 U	µg/kg	SW8270
			Acenaphthene	360 U	µg/kg	SW8270
			Dibenzofuran	360 U	µg/kg	SW8270
			Fluorene	360 U	µg/kg	SW8270
			Phenanthrene	360 U	µg/kg	SW8270
			Anthracene	360 U	µg/kg	SW8270
			Fluoranthene	360 U	µg/kg	SW8270
			Pyrene	360 U	µg/kg	SW8270
			Benzo(a)anthracene	360 U	µg/kg	SW8270
			Chrysene	360 U	µg/kg	SW8270
			Benzo(b)fluoranthene	360 U	µg/kg	SW8270
			Benzo(k)fluoranthene	360 U	µg/kg	SW8270
			Benzo(a)pyrene	360 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	360 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	360 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	360 U	µg/kg	SW8270
VW1-OT45	28-Sep-94	8.00 - 9.50	Naphthalene	330 U	µg/kg	SW8270
			2-Methylnaphthalene	330 U	µg/kg	SW8270
			Acenaphthylene	330 U	µg/kg	SW8270
			Acenaphthene	330 U	µg/kg	SW8270
			Dibenzofuran	330 U	µg/kg	SW8270
			Fluorene	330 U	µg/kg	SW8270
			Phenanthrene	330 U	µg/kg	SW8270
			Anthracene	330 U	µg/kg	SW8270
			Fluoranthene	330 U	µg/kg	SW8270
			Pyrene	330 U	µg/kg	SW8270
			Benzo(a)anthracene	330 U	µg/kg	SW8270
			Chrysene	330 U	µg/kg	SW8270
			Benzo(b)fluoranthene	330 U	µg/kg	SW8270
			Benzo(k)fluoranthene	330 U	µg/kg	SW8270
			Benzo(a)pyrene	330 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	330 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	330 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	330 U	µg/kg	SW8270
MPA-OT45	7-Oct-94	0.00 - .25	Naphthalene	360 U	µg/kg	SW8270
			2-Methylnaphthalene	360 U	µg/kg	SW8270
			Acenaphthylene	360 U	µg/kg	SW8270
			Acenaphthene	360 U	µg/kg	SW8270

**TABLE B.2**  
**VALIDATED SOIL DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
			Dibenzofuran	360 U	µg/kg	SW8270
			Fluorene	360 U	µg/kg	SW8270
			Phenanthrene	360 U	µg/kg	SW8270
			Anthracene	360 U	µg/kg	SW8270
			Fluoranthene	38 J	µg/kg	SW8270
			Pyrene	56 J	µg/kg	SW8270
			Benzo(a)anthracene	33 J	µg/kg	SW8270
			Chrysene	41 J	µg/kg	SW8270
			Benzo(b)fluoranthene	57 J	µg/kg	SW8270
			Benzo(k)fluoranthene	22 J	µg/kg	SW8270
			Benzo(a)pyrene	34 J	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	32 J	µg/kg	SW8270
			Dibenz(a,h)anthracene	360 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	30 J	µg/kg	SW8270
MPB-OT45	7-Oct-94	0.00 - .25	Naphthalene	410 U	µg/kg	SW8270
			2-Methylnaphthalene	410 U	µg/kg	SW8270
			Acenaphthylene	410 U	µg/kg	SW8270
			Acenaphthene	410 U	µg/kg	SW8270
			Dibenzofuran	410 U	µg/kg	SW8270
			Fluorene	410 U	µg/kg	SW8270
			Phenanthrene	410 U	µg/kg	SW8270
			Anthracene	410 U	µg/kg	SW8270
			Fluoranthene	33 J	µg/kg	SW8270
			Pyrene	47 J	µg/kg	SW8270
			Benzo(a)anthracene	27 J	µg/kg	SW8270
			Chrysene	26 J	µg/kg	SW8270
			Benzo(b)fluoranthene	34 J	µg/kg	SW8270
			Benzo(k)fluoranthene	410 U	µg/kg	SW8270
			Benzo(a)pyrene	21 J	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	410 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	410 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	410 U	µg/kg	SW8270
VW1-OT45	7-Oct-94	0.00 - .25	Naphthalene	360 U	µg/kg	SW8270
			2-Methylnaphthalene	360 U	µg/kg	SW8270
			Acenaphthylene	360 U	µg/kg	SW8270
			Acenaphthene	360 U	µg/kg	SW8270
			Dibenzofuran	360 U	µg/kg	SW8270
			Fluorene	360 U	µg/kg	SW8270
			Phenanthrene	360 U	µg/kg	SW8270
			Anthracene	360 U	µg/kg	SW8270
			Fluoranthene	360 U	µg/kg	SW8270
			Pyrene	360 U	µg/kg	SW8270
			Benzo(a)anthracene	360 U	µg/kg	SW8270
			Chrysene	360 U	µg/kg	SW8270
			Benzo(b)fluoranthene	360 U	µg/kg	SW8270
			Benzo(k)fluoranthene	360 U	µg/kg	SW8270
			Benzo(a)pyrene	360 U	µg/kg	SW8270
			Indeno(1,2,3-cd)pyrene	360 U	µg/kg	SW8270
			Dibenz(a,h)anthracene	360 U	µg/kg	SW8270
			Benzo(g,h,i)perylene	360 U	µg/kg	SW8270

U= analyte not detected above method detection limit  
J= estimated value

**TABLE B.3**  
**VALIDATED SOIL DATA FOR OTHER ANALYSIS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: beginning-ending)	Analyte	Result	Units	Analytical Method
MPA-OT45	28-Sep-94	8.00 - 9.50	Moisture, Percent	10	%	E160.3
			Phosphorus, Total Orthophosphate	2.78 U <sup>a</sup>	mg/kg	E300.0
			Nitrogen, Total Kjeldahl	5.35 U	mg/kg	E351.3
			pH	7.83	pH units	SW9045
MPB-OT45	28-Sep-94	8.00 - 9.50	Moisture, Percent	9.1	%	E160.3
			Phosphorus, Total Orthophosphate	2.75 U	mg/kg	E300.0
			Nitrogen, Total Kjeldahl	5.4 U	mg/kg	E351.3
			Iron	1300	mg/kg	SW6010
			Alkalinity, Carbonate	27.5 U	mg/kg	E310.1
MW4-OT45	29-Sep-94	8.00 - 9.50	pH	7.22	pH units	SW9045
			Nitrogen, Total Kjeldahl	5.75 U	mg/kg	E351.3
MW6-OT45	29-Sep-94	8.00 - 9.50	Total Organic Carbon	0.15	%	SW9060
MW8-OT45	29-Sep-94	8.00 - 9.50	Total Organic Carbon	0.06	%	SW9060
MW10-OT45	6-Oct-94	68 - 70	Total Organic Carbon	0.06	%	SW9060
			Phosphorus, Total Orthophosphate	2.98 U	mg/kg	E300.0
			Nitrogen, Total Kjeldahl	195	mg/kg	E351.3
			pH	9.28	pH units	SW9045
MW11-OT45	7-Oct-94	12.00 - 14.00	Total Organic Carbon	0.16	%	SW9060
			Total Organic Carbon	0.05 U	%	SW9060
VW1-OT45	28-Sep-94	8.00 - 9.50	Moisture, Percent	11.5	%	E160.3
			Phosphorus, Total Orthophosphate	2.84 U	mg/kg	E300.0
			Nitrogen, Total Kjeldahl	5.51 U	mg/kg	E351.3
			Iron	1500	mg/kg	SW6010
			Alkalinity, Carbonate	28.2 U	mg/kg	E310.1
			pH	7.86	pH units	SW9045

<sup>a</sup> U= analyte not detected above method detection limit



**TABLE B.4**  
**VALIDATED SOIL GAS DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Interval (ft bgs: begining-ending)	Analyte	Result	Units	Analytical Method
MPB-OT45	11-Oct-94	9.00 - 9.50	Benzene	0.017 U <sup>a</sup>	µg/L	TO3
			Toluene	0.02 U	µg/L	TO3
			Ethylbenzene	1.4	µg/L	TO3
			Xylenes (Total)	3.2	µg/L	TO3
			Petroleum Hydrocarbons	2100	µg/L	TO3
MW2-OT45	8-Oct-94	5.00 - 10.00	Benzene	0.006 U	µg/L	TO3
			Toluene	0.008 U	µg/L	TO3
			Ethylbenzene	0.17	µg/L	TO3
			Xylenes (Total)	0.53	µg/L	TO3
			Petroleum Hydrocarbons	380	µg/L	TO3
VW1-OT45	8-Oct-94	5.00 - 10.00	Benzene	0.006 U	µg/L	TO3
			Toluene	0.008 U	µg/L	TO3
			Ethylbenzene	0.26	µg/L	TO3
			Xylenes (Total)	1	µg/L	TO3
			Petroleum Hydrocarbons	910	µg/L	TO3

<sup>a</sup> U= analyte not detected above method detection limit

**TABLE B.5**  
**VALIDATED SOIL FLUX DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**AND TOTAL PETROLEUM HYDROCARBONS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
BKG-OT45	11-Oct-94	Benzene	0.006 U <sup>a</sup>	µg/L	TO3
		Toluene	0.008 U	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.031	µg/L	TO3
		Petroleum Hydrocarbons	13	µg/L	TO3
MPB-OT45	11-Oct-94	Benzene	0.006 U	µg/L	TO3
		Toluene	0.034	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.013	µg/L	TO3
		Petroleum Hydrocarbons	1.6	µg/L	TO3
MPB-OT45	18-Oct-94	Benzene	0.007 U	µg/L	TO3
		Toluene	0.008 U	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.009 U	µg/L	TO3
		Petroleum Hydrocarbons	1.4	µg/L	TO3
MW2-OT45	11-Oct-94	Benzene	0.006 U	µg/L	TO3
		Toluene	0.008	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.009 U	µg/L	TO3
		Petroleum Hydrocarbons	4.9	µg/L	TO3
MW2-OT45	18-Oct-94	Benzene	0.007 U	µg/L	TO3
		Toluene	0.023	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.009 U	µg/L	TO3
		Petroleum Hydrocarbons	3.1	µg/L	TO3
VW1-OT45	11-Oct-94	Benzene	0.006 U	µg/L	TO3
		Toluene	0.038	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.009 U	µg/L	TO3
		Petroleum Hydrocarbons	2.6	µg/L	TO3
VW1-OT45	18-Oct-94	Benzene	0.007 U	µg/L	TO3
		Toluene	0.008	µg/L	TO3
		Ethylbenzene	0.009 U	µg/L	TO3
		Xylenes (Total)	0.009 U	µg/L	TO3
		Petroleum Hydrocarbons	1	µg/L	TO3

<sup>a</sup> U= analyte not detected above method detection limit

**TABLE B.5  
FLUX CALCULATIONS  
REMEDIAL ACTION PLAN  
RISK-BASED APPROACH TO REMEDIATION  
SITE OT45, WURTSMITH AFB, MICHIGAN**

BG-10/11/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.006	0	0.164	5	0.18292683	15.9	9.8	2.21001654	0.404271	MDL USED TO CALC. EMISSIONS
toluene	0.009	0	0.164	5	0.27439024				0.606407	MDL USED TO CALC. EMISSIONS
ethylbenzene	0.009	0	0.164	5	0.27439024				0.606407	MDL USED TO CALC. EMISSIONS
xylenes	0.031	1	0.164	5	0.94512195				2.088735	ANALYTE DETECTED
lph	13	1	0.164	5	396.341463				875.9212	ANALYTE DETECTED
VW1-10/11/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.006	0	0.164	5	0.18292683	10.9	11.8	0.88958519	0.162729	MDL USED TO CALC. EMISSIONS
toluene	0.038	1	0.164	5	1.15853659				1.030617	ANALYTE DETECTED
ethylbenzene	0.009	0	0.164	5	0.27439024				0.244093	MDL USED TO CALC. EMISSIONS
xylenes	0.009	0	0.164	5	0.27439024				0.244093	MDL USED TO CALC. EMISSIONS
lph	2.6	1	0.164	5	79.2682927				70.5159	ANALYTE DETECTED
MPB-10/11/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.006	0	0.164	5	0.18292683	22.5	13	3.43837852	0.628972	MDL USED TO CALC. EMISSIONS
toluene	0.034	1	0.164	5	1.03658537				3.564173	ANALYTE DETECTED
ethylbenzene	0.009	0	0.164	5	0.27439024				0.943458	MDL USED TO CALC. EMISSIONS
xylenes	0.013	1	0.164	5	0.39634146				1.362772	ANALYTE DETECTED
lph	1.6	1	0.164	5	48.7804878				167.7258	ANALYTE DETECTED
MW2-10/11/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.006	0	0.164	5	0.18292683	21.2	12.8	2.98022857	0.545164	MDL USED TO CALC. EMISSIONS
toluene	0.008	1	0.164	5	0.24390244				0.726885	ANALYTE DETECTED
ethylbenzene	0.009	0	0.164	5	0.27439024				0.817746	MDL USED TO CALC. EMISSIONS
xylenes	0.009	0	0.164	5	0.27439024				0.817746	MDL USED TO CALC. EMISSIONS
lph	4.9	1	0.164	5	149.390244				445.2171	ANALYTE DETECTED
VW1-10/18/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.007	0	0.164	5	0.21341463	15.6	16.7	0.86675407	0.184978	MDL USED TO CALC. EMISSIONS
toluene	0.008	1	0.164	5	0.24390244				0.211403	ANALYTE DETECTED
ethylbenzene	0.009	0	0.164	5	0.27439024				0.237829	MDL USED TO CALC. EMISSIONS
xylenes	0.009	0	0.164	5	0.27439024				0.237829	MDL USED TO CALC. EMISSIONS
lph	1	1	0.164	5	30.4878049				26.42543	ANALYTE DETECTED
MPB-10/18/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.007	0	0.164	5	0.21341463	16.8	17.2	0.94932887	0.202601	MDL USED TO CALC. EMISSIONS
toluene	0.008	0	0.164	5	0.24390244				0.231544	MDL USED TO CALC. EMISSIONS
ethylbenzene	0.009	0	0.164	5	0.27439024				0.260487	MDL USED TO CALC. EMISSIONS
xylenes	0.009	0	0.164	5	0.27439024				0.260487	MDL USED TO CALC. EMISSIONS
lph	1.4	1	0.164	5	42.6829268				40.52013	ANALYTE DETECTED
MW2-10/18/94										
ANALYTE	MEAS. CONC. µg/L		AREA m <sup>2</sup>	FLOWRATE L/min	Erate(uncor.) µg/min m <sup>2</sup>	temp(c)	temp(a)	C factor	Erate	
benzene	0.007	0	0.164	5	0.21341463	17.8	17.5	1.03977048	0.221902	MDL USED TO CALC. EMISSIONS
toluene	0.023	1	0.164	5	0.70121951				0.729107	ANALYTE DETECTED
ethylbenzene	0.009	0	0.164	5	0.27439024				0.285303	MDL USED TO CALC. EMISSIONS
xylenes	0.009	0	0.164	5	0.27439024				0.285303	MDL USED TO CALC. EMISSIONS
lph	3.1	1	0.164	5	94.5121951				98.27099	ANALYTE DETECTED

**TABLE B.6**  
**VALIDATED GROUND WATER DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW6-OT45	30-Sep-94	1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW7-OT45	28-Sep-94	Benzene	1.7 J	µg/L	SW8020
		Toluene	0.4 J	µg/L	SW8020
		Ethylbenzene	1 J	µg/L	SW8020
		Xylenes (Total)	0.6 J	µg/L	SW8020
		1,3,5-Trimethylbenzene	1.3 J	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
	12-Oct-94	Total Extractable Hydrocarbons	5 U	mg/L	M8015
		Total Volatile Hydrocarbons	1 U	mg/L	M8015
MW8-OT45	30-Sep-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW9-OT45	12-Oct-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW10-OT45	5-Oct-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	0.9 J	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW11-OT45	12-Oct-94	Benzene	1 J	µg/L	SW8240
		Toluene	5 U	µg/L	SW8240
		Ethylbenzene	5 U	µg/L	SW8240
		Xylenes (Total)	5 U	µg/L	SW8240
		1,3,5-Trimethylbenzene	5 U	µg/L	SW8240
		1,2,4-Trimethylbenzene	5 U	µg/L	SW8240
		1,2,3-Trimethylbenzene	5 U	µg/L	SW8240
VW1-OT45	10-Oct-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	1.5 J	µg/L	SW8020
		Ethylbenzene	7.2	µg/L	SW8020
		Xylenes (Total)	23	µg/L	SW8020
		1,3,5-Trimethylbenzene	43	µg/L	SW8020
		1,2,4-Trimethylbenzene	82	µg/L	SW8020
		1,2,3-Trimethylbenzene	36	µg/L	SW8020
	12-Oct-94	Total Extractable Hydrocarbons	5 U	mg/L	M8015
		Total Volatile Hydrocarbons	1 U	mg/L	M8015

\* U= analyte not detected above method detection limit

\* J= estimated value

\* UJ=estimated concentration of analyte not detected above method detection limit

**TABLE B.7**  
**VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MPB-OT45	10-Oct-94	Naphthalene	9 J <sup>w</sup>	µg/L	SW8270
		2-Methylnaphthalene	35	µg/L	SW8270
		Acenaphthylene	10 U <sup>w</sup>	µg/L	SW8270
		Acenaphthene	2 J	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	3 J	µg/L	SW8270
		Phenanthrene	7 J	µg/L	SW8270
		Anthracene	1 J	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW1-OT45	13-Oct-94	Naphthalene	10 U	µg/L	SW8270
		2-Methylnaphthalene	10 U	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	10 U	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	10 U	µg/L	SW8270
		Phenanthrene	10 U	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW2-OT45	10-Oct-94	Naphthalene	150	µg/L	SW8270
		2-Methylnaphthalene	230	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	19	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	26	µg/L	SW8270
		Phenanthrene	70	µg/L	SW8270
		Anthracene	5 J	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270

**TABLE B.6**  
**VALIDATED GROUND WATER DATA FOR VOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MPB-OT45	10-Oct-94	Benzene	0.4 U <sup>u</sup>	µg/L	SW8020
		Toluene	4.3	µg/L	SW8020
		Ethylbenzene	2.6 J <sup>u</sup>	µg/L	SW8020
		Xylenes (Total)	14	µg/L	SW8020
		1,3,5-Trimethylbenzene	17	µg/L	SW8020
		1,2,4-Trimethylbenzene	36	µg/L	SW8020
		1,2,3-Trimethylbenzene	25	µg/L	SW8020
MW1-OT45	13-Oct-94	Total Extractable Hydrocarbons	5 U	mg/L	M8015
		Total Volatile Hydrocarbons	1 U	mg/L	M8015
		Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW2-OT45	10-Oct-94	Total Extractable Hydrocarbons	20 J	mg/L	M8015
		Total Volatile Hydrocarbons	0.5 J	mg/L	M8015
		Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW3-OT45	10-Oct-94	Total Extractable Hydrocarbons	5 UJ <sup>u</sup>	mg/L	M8015
		Total Volatile Hydrocarbons	1.1	mg/L	M8015
		Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW4-OT45	13-Oct-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	4 U	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,4-Trimethylbenzene	4 U	µg/L	SW8020
		1,2,3-Trimethylbenzene	4 U	µg/L	SW8020
MW5-OT45	11-Oct-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	1.5 J	µg/L	SW8020
		Ethylbenzene	6.3	µg/L	SW8020
		Xylenes (Total)	23	µg/L	SW8020
		1,3,5-Trimethylbenzene	19	µg/L	SW8020
		1,2,4-Trimethylbenzene	63	µg/L	SW8020
		1,2,3-Trimethylbenzene	37	µg/L	SW8020
MW6-OT45	30-Sep-94	Benzene	0.4 U	µg/L	SW8020
		Toluene	0.4 J	µg/L	SW8020
		Ethylbenzene	4 U	µg/L	SW8020
		Xylenes (Total)	4 U	µg/L	SW8020
		1,3,5-Trimethylbenzene	4 U	µg/L	SW8020

**TABLE B.7**  
**VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW2-OT45	10-Oct-94	Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW5-OT45	11-Oct-94	Naphthalene	32	µg/L	SW8270
		2-Methylnaphthalene	23	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	1 J	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	2 J	µg/L	SW8270
		Phenanthrene	1 J	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW6-OT45	30-Sep-94	Naphthalene	10 U	µg/L	SW8270
		2-Methylnaphthalene	10 U	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	10 U	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	10 U	µg/L	SW8270
		Phenanthrene	10 U	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW7-OT45	28-Sep-94	Naphthalene	64	µg/L	SW8270
		2-Methylnaphthalene	1 J	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	10 U	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	10 U	µg/L	SW8270

**TABLE B.7**  
**VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW7-OT45	28-Sep-94	Phenanthrene	10 U	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW8-OT45	30-Sep-94	Naphthalene	10 U	µg/L	SW8270
		2-Methylnaphthalene	10 U	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	10 U	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	10 U	µg/L	SW8270
		Phenanthrene	10 U	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270
MW10-OT45	5-Oct-94	Naphthalene	10 U	µg/L	SW8270
		2-Methylnaphthalene	10 U	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	10 U	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	10 U	µg/L	SW8270
		Phenanthrene	10 U	µg/L	SW8270
		Anthracene	10 U	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270



**TABLE B.7**  
**VALIDATED GROUND WATER DATA FOR SEMIVOLATILE ORGANIC COMPOUNDS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
VW1-OT45	10-Oct-94	Naphthalene	13	µg/L	SW8270
		2-Methylnaphthalene	41	µg/L	SW8270
		Acenaphthylene	10 U	µg/L	SW8270
		Acenaphthene	7 J	µg/L	SW8270
		Dibenzofuran	10 U	µg/L	SW8270
		Fluorene	9 J	µg/L	SW8270
		Phenanthrene	19	µg/L	SW8270
		Anthracene	1 J	µg/L	SW8270
		Fluoranthene	10 U	µg/L	SW8270
		Pyrene	10 U	µg/L	SW8270
		Benzo(a)anthracene	10 U	µg/L	SW8270
		Chrysene	10 U	µg/L	SW8270
		Benzo(b)fluoranthene	10 U	µg/L	SW8270
		Benzo(k)fluoranthene	10 U	µg/L	SW8270
		Benzo(a)pyrene	10 U	µg/L	SW8270
		Indeno(1,2,3-cd)pyrene	10 U	µg/L	SW8270
		Dibenz(a,h)anthracene	10 U	µg/L	SW8270
		Benzo(g,h,i)perylene	10 U	µg/L	SW8270

<sup>a</sup> J= estimated value

<sup>b</sup> U= analyte not detected above method detection limit

**TABLE B.8**  
**VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MPB-OT45	10-Oct-94	Dissolved Oxygen	0.63	mg/L	FDO
	12-Oct-94	Iron	1.99	mg/L	H8008
		Nitrate	0.9	mg/L	H8039
		Sulfate	39.52	mg/L	H8051
		Hydrogen Sulfide	0.1	mg/L	H8131
		Iron, Ferrous	1.47	mg/L	H8146
		Carbon Dioxide	200	mg/L	H8223
		Nitrite	0.005 U <sup>a</sup>	mg/L	H8507
		Manganese	1.3	mg/L	HMANG
MW1-OT45	13-Oct-94	Carbon Dioxide	132	mg/L	COU-O2
		Dissolved Oxygen	7.52	mg/L	FDO
		Iron	0.01	mg/L	H8008
		Nitrate	0.8	mg/L	H8039
		Sulfate	45.5	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.02	mg/L	H8146
		Carbon Dioxide	41.25	mg/L	H8223
		Nitrite	0.005 U	mg/L	H8507
		Manganese	0.05 U	mg/L	HMANG
		Methane	0.001 U	mg/L	METHAN
MW2-OT45	10-Oct-94	Carbon Dioxide	209	mg/L	COU-O2
		Methane	0.001 U	mg/L	METHAN
MW3-OT45	10-Oct-94	Carbon Dioxide	48	mg/L	COU-O2
		Dissolved Oxygen	0.5	mg/L	FDO
		Methane	0.002	mg/L	METHAN
	13-Oct-94	Iron	0.04	mg/L	H8008
		Nitrate	0.066 U	mg/L	H8039
		Sulfate	8.57	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.01	mg/L	H8146
		Carbon Dioxide	5	mg/L	H8223
		Nitrite	0.001	mg/L	H8507
		Manganese	0.05 U	mg/L	HMANG
MW4-OT45	13-Oct-94	Dissolved Oxygen	8.71	mg/L	FDO
		Iron	0.16	mg/L	H8008
		Nitrate	2.3	mg/L	H8039
		Sulfate	33.3	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.04	mg/L	H8146
		Carbon Dioxide	8.75	mg/L	H8223
		Nitrite	0.005 U	mg/L	H8507
		Manganese	0.1	mg/L	HMANG
MW5-OT45	11-Oct-94	Dissolved Oxygen	1.8	mg/L	FDO
		Iron	0.74	mg/L	H8008
		Nitrate	0.4	mg/L	H8039
		Sulfate	0.01 U	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.72	mg/L	H8146

**TABLE B.8**  
**VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW5-OT45	11-Oct-94	Carbon Dioxide	58.75	mg/L	H8223
		Nitrite	0.026	mg/L	H8507
		Manganese	0.2	mg/L	HMANG
MW6-OT45	13-Oct-94	Dissolved Oxygen	7.5	mg/L	FDO
		Iron	0.92	mg/L	H8008
		Nitrate	0.066 U	mg/L	H8039
		Sulfate	34.59	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.05	mg/L	H8146
		Carbon Dioxide	8.75	mg/L	H8223
		Nitrite	0.002	mg/L	H8507
		Manganese	0.2	mg/L	HMANG
MW7-OT45	12-Oct-94	Carbon Dioxide	205	mg/L	COU-O2
		Dissolved Oxygen	0.03	mg/L	FDO
		Iron	0.19	mg/L	H8008
		Nitrate	0.3	mg/L	H8039
		Sulfate	24.64	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.05	mg/L	H8146
		Carbon Dioxide	27.5	mg/L	H8223
		Nitrite	0.013	mg/L	H8507
		Manganese	1.1	mg/L	HMANG
		Methane	0.001 U	mg/L	METHAN
MW8-OT45	13-Oct-94	Dissolved Oxygen	0.61	mg/L	FDO
		Iron	0.76	mg/L	H8008
		Nitrate	0.1	mg/L	H8039
		Sulfate	26.94	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.07	mg/L	H8146
		Carbon Dioxide	16.25	mg/L	H8223
		Nitrite	0.005	mg/L	H8507
		Manganese	0.6	mg/L	HMANG
MW9-OT45	12-Oct-94	Iron	0.01	mg/L	H8008
		Nitrate	1.6	mg/L	H8039
		Sulfate	18.75	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.02	mg/L	H8146
		Carbon Dioxide	10	mg/L	H8223
		Nitrite	0.005 U	mg/L	H8507
		Manganese	0.3	mg/L	HMANG
MW10-OT45	5-Oct-94	Dissolved Oxygen	0.4	mg/L	FDO
	11-Oct-94	Iron	0.22	mg/L	H8008
		Nitrate	0.1	mg/L	H8039
		Sulfate	6.41	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
MW10-OT45	11-Oct-94	Iron, Ferrous	0.2	mg/L	H8146
		Carbon Dioxide	16.25	mg/L	H8223
		Nitrite	0.002	mg/L	H8507

**TABLE B.8**  
**VALIDATED GROUND WATER DATA FOR OTHER RELEVANT ANALYSES**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW10-OT45	11-Oct-94	Manganese	0.05 U	mg/L	HMANG
MW11-OT45	12-Oct-94	Dissolved Oxygen	7.55	mg/L	FDO
		Iron	0.024 U	mg/L	H8008
		Nitrate	0.4	mg/L	H8039
		Sulfate	18.71	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	0.01	mg/L	H8146
		Carbon Dioxide	12.5	mg/L	H8223
		Nitrite	0.013	mg/L	H8507
		Manganese	0.3	mg/L	HMANG
VW1-OT45	10-Oct-94	Dissolved Oxygen	1.6	mg/L	FDO
	12-Oct-94	Iron	1.75	mg/L	H8008
		Nitrate	0.8	mg/L	H8039
		Sulfate	16.84	mg/L	H8051
		Hydrogen Sulfide	0.024 U	mg/L	H8131
		Iron, Ferrous	1.42	mg/L	H8146
		Carbon Dioxide	38.75	mg/L	H8223
		Nitrite	0.005	mg/L	H8507
		Manganese	0.8	mg/L	HMANG

<sup>a/</sup> U = Analyte Not Detected Above Method Detection Limit

**TABLE B.9**  
**GEOCHEMICAL DATA MEASURED IN THE FIELD**  
**REMEDIATION ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MPB-OT45	10-Oct-94	Electrical Conductivity	0.404 J <sup>F29</sup>	mmhos/cm	FCOND
		pH	6.34 J	pH units	FPH
		Redox potential	2.85835 J	pE units	FREDOX
		Temperature	13.4 J	°C	FTEMP
	12-Oct-94	Alkalinity, Carbonate	220 J	mg/L	H8221
MW1-OT45	13-Oct-94	Electrical Conductivity	0.333 J	mmhos/cm	FCOND
		pH	6.48 J	pH units	FPH
		Redox potential	2.42224 J	pE units	FREDOX
		Temperature	14.1 J	°C	FTEMP
		Alkalinity, Carbonate	100 J	mg/L	H8221
MW3-OT45	10-Oct-94	Electrical Conductivity	0.17 J	mmhos/cm	FCOND
		pH	8.7 J	pH units	FPH
	13-Oct-94	Alkalinity, Carbonate	80 J	mg/L	H8221
MW4-OT45	13-Oct-94	Electrical Conductivity	0.255 J	mmhos/cm	FCOND
		pH	7.29 J	pH units	FPH
		Redox potential	2.89723 J	pE units	FREDOX
		Temperature	13.7 J	°C	FTEMP
		Alkalinity, Carbonate	80 J	mg/L	H8221
MW5-OT45	11-Oct-94	Electrical Conductivity	0.322 J	mmhos/cm	FCOND
		pH	7.02 J	pH units	FPH
		Redox potential	2.94963 J	pE units	FREDOX
		Temperature	11.8 J	°C	FTEMP
		Alkalinity, Carbonate	160 J	mg/L	H8221
MW6-OT45	13-Oct-94	Electrical Conductivity	0.184 J	mmhos/cm	FCOND
		pH	8.01 J	pH units	FPH
		Redox potential	2.44929 J	pE units	FREDOX
		Temperature	13.3 J	°C	FTEMP
		Alkalinity, Carbonate	80 J	mg/L	H8221
MW7-OT45	12-Oct-94	Electrical Conductivity	0.556 J	mmhos/cm	FCOND
		pH	7.16 J	pH units	FPH
		Redox potential	3.39249 J	pE units	FREDOX
		Temperature	13.5 J	°C	FTEMP
		Alkalinity, Carbonate	180 J	mg/L	H8221
MW8-OT45	13-Oct-94	Electrical Conductivity	0.384 J	mmhos/cm	FCOND
		pH	7.48 J	pH units	FPH
		Redox potential	2.69439 J	pE units	FREDOX
		Temperature	13.1 J	°C	FTEMP
		Alkalinity, Carbonate	180 J	mg/L	H8221
MW9-OT45	12-Oct-94	Electrical Conductivity	0.318 J	mmhos/cm	FCOND
		pH	7.49 J	pH units	FPH
		Redox potential	4.74814 J	pE units	FREDOX
		Temperature	13.3 J	°C	FTEMP
		Alkalinity, Carbonate	160 J	mg/L	H8221
MW10-OT45	5-Oct-94	Electrical Conductivity	0.265 J	mmhos/cm	FCOND
		pH	8.05 J	pH units	FPH
		Redox potential	1.13252 J	pE units	FREDOX

**TABLE B.9**  
**GEOCHEMICAL DATA MEASURED IN THE FIELD**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
MW10-OT45	5-Oct-94	Temperature	10.8 J	°C	FTEMP
	11-Oct-94	Alkalinity, Carbonate	160 J	mg/L	H8221
MW11-OT45	12-Oct-94	Electrical Conductivity	0.353 J	mmhos/cm	FCOND
		pH	7.52 J	pH units	FPH
		Redox potential	4.09398 J	pE units	FREDOX
		Temperature	13.3 J	°C	FTEMP
		Alkalinity, Carbonate	180 J	mg/L	H8221
VW1-OT45	10-Oct-94	Electrical Conductivity	0.309 J	mmhos/cm	FCOND
		pH	6.82 J	pH units	FPH
		Redox potential	3.43475 J	pE units	FREDOX
		Temperature	12.2 J	°C	FTEMP
	12-Oct-94	Alkalinity, Carbonate	160 J	mg/L	H8221

\* J= estimated value

**TABLE B.10**  
**QA/QC WATER BLANKS**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Type	Sample Date	Matrix
Equipment Blank	29-Sep-94	Water
Field Blank	29-Sep-94	Water
Trip Blank	06-Oct-94	Water
Trip Blank	28-Sep-94	Water
Trip Blank	03-Oct-94	Water
Trip Blank	14-Oct-94	Water
Water Supply Blank	29-Sep-94	Water

Note:

- 1) Trip blanks were associated by date.
- 2) No samples were qualified due rinsate contamination because no analytes were detected in any of the blanks.

**TABLE B.11**  
**DATA VALIDATION QUALIFIER APPLICATION**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITEOT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Matrix	Analytical Method	Laboratory Result <sup>a/</sup>	Holding Time Flag <sup>b/</sup>	Method Blank Flag <sup>c/</sup>	PQL Flag <sup>d/</sup>	Final Report
DC-OT45	28-Sep-94	Total Extractable Hydrocarbons	Drill Cutting	M8015	=	J			J
		Ethylbenzene	Drill Cutting	SW8020	=			J	J
		Acenaphthene	Drill Cutting	SW8270	=			J	J
		Dibenzofuran	Drill Cutting	SW8270	=			J	J
		Fluorene	Drill Cutting	SW8270	=			J	J
		Pyrene	Drill Cutting	SW8270	=			J	J
MPA-OT45	28-Sep-94	Total Extractable Hydrocarbons	Soil	M8015	ND	J			UJ
		Toluene	Soil	SW8020	=			J	J
	07-Oct-94	Benzo(a)anthracene	Soil	SW8270	=			J	J
		Benzo(a)pyrene	Soil	SW8270	=			J	J
		Benzo(b)fluoranthene	Soil	SW8270	=			J	J
		Benzo(g,h,i)perylene	Soil	SW8270	=			J	J
		Benzo(k)fluoranthene	Soil	SW8270	=			J	J
		Chrysene	Soil	SW8270	=			J	J
		Fluoranthene	Soil	SW8270	=			J	J
		Indeno(1,2,3-cd)pyrene	Soil	SW8270	=			J	J
		Pyrene	Soil	SW8270	=			J	J
	28-Sep-94	Total Extractable Hydrocarbons	Soil	M8015	=				J
		Ethylbenzene	Soil	SW8020	=			J	J
		Benzo(a)anthracene	Soil	SW8270	=			J	J
		Benzo(a)pyrene	Soil	SW8270	=			J	J
		Benzo(b)fluoranthene	Soil	SW8270	=			J	J
		Chrysene	Soil	SW8270	=			J	J
		Fluoranthene	Soil	SW8270	=			J	J
		Pyrene	Soil	SW8270	=			J	J
MPB-OT45	07-Oct-94	Total Extractable Hydrocarbons	Soil	M8015	=	J			J
		Ethylbenzene	Soil	SW8020	=			J	J
		Benzo(a)anthracene	Soil	SW8270	=			J	J
		Benzo(a)pyrene	Soil	SW8270	=			J	J
		Benzo(b)fluoranthene	Soil	SW8270	=			J	J
		Chrysene	Soil	SW8270	=			J	J
		Fluoranthene	Soil	SW8270	=			J	J
		Pyrene	Soil	SW8270	=			J	J



**TABLE B.11**  
**DATA VALIDATION QUALIFIER APPLICATION**  
**REMEDIATION ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Matrix	Analytical Method	Laboratory Result <sup>a/</sup>	Holding Time Flag <sup>b/</sup>	Method Blank Flag <sup>c/</sup>	PQL Flag <sup>d/</sup>	Final Report
MW10-OT45	03-Oct-94	1,2,3-Trimethylbenzene	Soil	SW8020	ND	J			UJ
		1,2,4-Trimethylbenzene	Soil	SW8020	ND	J			UJ
		1,3,5-Trimethylbenzene	Soil	SW8020	ND	J			UJ
		Benzene	Soil	SW8020	ND	J			UJ
		Ethylbenzene	Soil	SW8020	ND	J			UJ
		Toluene	Soil	SW8020	=		U	J	U
		Toluene	Soil	SW8020	ND	J		J	UJ
		Xylenes (Total)	Soil	SW8020	=		U	J	U
		Xylenes (Total)	Soil	SW8020	ND	J			UJ
MW5-OT45	29-Sep-94	1,2,3-Trimethylbenzene	Soil	SW8020	=	J			J
		1,2,4-Trimethylbenzene	Soil	SW8020	=	J			J
		1,3,5-Trimethylbenzene	Soil	SW8020	=	J			J
		Acenaphthene	Soil	SW8270	=			J	J
		Pyrene	Soil	SW8270	=			J	J
MW6-OT45	29-Sep-94	Toluene	Soil	SW8020	=		U	J	U
		Xylenes (Total)	Soil	SW8020	=		U	J	U
MW7-OT45	27-Sep-94	Total Extractable Hydrocarbons	Soil	M8015	=	J		J	J
		1,2,3-Trimethylbenzene	Soil	SW8020	ND	J			UJ
		1,2,4-Trimethylbenzene	Soil	SW8020	ND	J			UJ
		1,3,5-Trimethylbenzene	Soil	SW8020	=	J		J	J
		Benzene	Soil	SW8020	ND	J			UJ
		Ethylbenzene	Soil	SW8020	ND	J			UJ
		Toluene	Soil	SW8020	=	J	U	J	UJ
		Xylenes (Total)	Soil	SW8020	=	J	U	J	UJ
MW9-OT45	29-Sep-94	1,2,3-Trimethylbenzene	Soil	SW8020	=			J	J
		1,2,4-Trimethylbenzene	Soil	SW8020	=			J	J

**TABLE B.11**  
**DATA VALIDATION QUALIFIER APPLICATION**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Matrix	Analytical Method	Laboratory Result <sup>a</sup>	Holding Time Flag <sup>b</sup>	Method Blank Flag <sup>c</sup>	PQL Flag <sup>d</sup>	Final Report
MW9-OT45	29-Sep-94	Xylenes (Total)	Soil	SW8020	=		U	J	U
VW1-OT45	28-Sep-94	Total Extractable Hydrocarbons	Soil	M8015	=	J		J	J
		1,3,5-Trimethylbenzene	Soil	SW8020	=			J	J
		Toluene	Soil	SW8020	=		U	J	U
		Xylenes (Total)	Soil	SW8020	=		U	J	U
MPB-OT45	10-Oct-94	Ethylbenzene	Water	SW8020	=			J	J
		Acenaphthene	Water	SW8270	=			J	J
		Anthracene	Water	SW8270	=			J	J
		Fluorene	Water	SW8270	=			J	J
		Naphthalene	Water	SW8270	=			J	J
		Phenanthrene	Water	SW8270	=			J	J
MW1-OT45	13-Oct-94	Iron	Water	H8008	=			J	J
		Iron, Ferrous	Water	H8146	=			J	J
MW10-OT45	11-Oct-94 05-Oct-94	Nitrite	Water	H8507	=			J	J
		Toluene	Water	SW8020	=			J	J
		Xylenes (Total)	Water	SW8020	=		U	J	U
MW11-OT45	12-Oct-94	Iron, Ferrous	Water	H8146	=			J	J
		Nitrite	Water	H8507	=			J	J
		Benzene	Water	SW8020	=			J	J
		Benzene	Water	SW8240	=			J	J
MW2-OT45	10-Oct-94	Total Extractable Hydrocarbons	Water	M8015	=	J			J
		Total Volatile Hydrocarbons	Water	M8015	=		U	J	J
		Xylenes (Total)	Water	SW8020	=			J	U
		Anthracene	Water	SW8270	=			J	J
MW3-OT45	13-Oct-94	Iron	Water	H8008	=			J	J
		Iron, Ferrous	Water	H8146	=			J	J

**TABLE B.11**  
**DATA VALIDATION QUALIFIER APPLICATION**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Matrix	Analytical Method	Laboratory Result <sup>d</sup>	Holding Time Flag <sup>b,c</sup>	Method Blank Flag <sup>d</sup>	PQL Flag <sup>d</sup>	Final Report
MW3-OT45	13-Oct-94	Nitrite	Water	H8507	=			J	J
		Total Extractable Hydrocarbons	Water	M8015	ND	J			UJ
		Methane	Water	RSK175	=			J	J
MW4-OT45	13-Oct-94	Iron, Ferrous	Water	H8146	=			J	J
MW5-OT45	11-Oct-94	Nitrite	Water	H8507	=			J	J
		Toluene	Water	SW8020	=			J	J
		Acenaphthene	Water	SW8270	=			J	J
		Fluorene	Water	SW8270	=			J	J
		Phenanthrene	Water	SW8270	=			J	J
MW6-OT45	13-Oct-94	Nitrite	Water	H8507	=			J	J
		Toluene	Water	SW8020	=			J	J
MW7-OT45	12-Oct-94	Nitrite	Water	H8507	=			J	J
		1,3,5-Trimethylbenzene	Water	SW8020	=			J	J
		Benzene	Water	SW8020	=			J	J
		Ethylbenzene	Water	SW8020	=			J	J
		Toluene	Water	SW8020	=			J	J
		Xylenes (Total)	Water	SW8020	=			J	J
MW8-OT45	13-Oct-94	2-Methylnaphthalene	Water	SW8270	=			J	J
		Nitrite	Water	H8507	=			J	J
MW9-OT45	12-Oct-94	Iron	Water	H8008	=			J	J
		Iron, Ferrous	Water	II8146	=			J	J
VW1-OT45	12-Oct-94	Nitrite	Water	H8507	=			J	J
		Toluene	Water	SW8020	=			J	J
		Acenaphthene	Water	SW8270	=			J	J
		Anthracene	Water	SW8270	=			J	J
		Fluorene	Water	SW8270	=			J	J

TABLE B.11  
DATA VALIDATION QUALIFIER APPLICATION  
REMEDIAL ACTION PLAN  
RISK-BASED APPROACH TO REMEDIATION  
SITEOT45, WURTSMITH AFB, MICHIGAN

Sample Location	Sample Date	Analyte	Matrix	Analytical Method	Laboratory Result <sup>a/</sup>	Holding Time Flag <sup>b/</sup>	Method Blank Flag <sup>c/</sup>	PQL Flag <sup>d/</sup>	Final Report
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<sup>a/</sup> = Result reported by analytical laboratory. ND = not detected. "=" = An real value was reported.

<sup>b/</sup> = A flag was applied to the data because sample holding time was exceeded.

<sup>c/</sup> = A flag was applied because an analyte was detected during the analysis of a method blank.

<sup>d/</sup> = A flag was applied because the reported value was above the MDL and below the PQL.

TABLE B.12  
DUPLICATE AND REPLICATE SAMPLE RESULTS  
REMEDIAL ACTION PLAN  
RISK-BASED APPROACH TO REMEDIATION  
SITE OT45, WURTSMITH AFB, MICHIGAN

Sample Location	Sample Date	Matrix	Analytical Method	Sample Interval (ft bgs: beginning-ending)	Analyte	Real Sample Result	Duplicate Sample Result	Units	RPD <sup>a</sup>
MPB-OT45	11-Oct-94	Soil Gas	TO3	9 - 9.5	Benzene	0.017 U	0.017 U	µg/L	
			TO3	9 - 9.5	Toluene	0.02 U	0.02 U	µg/L	
			TO3	9 - 9.5	Ethylbenzene	1.4	1.7	µg/L	9.68
			TO3	9 - 9.5	Petroleum Hydrocarbons	2100	2100	µg/L	0.00
			TO3	9 - 9.5	Xylenes (Total)	3.2	3.4	µg/L	3.03
VW1-OT45	08-Oct-94	Soil Gas	TO3	5 - 10	Benzene	0.006 U	0.006 U	µg/L	
			TO3	5 - 10	Toluene	0.008 U	0.008 U	µg/L	
			TO3	5 - 10	Ethylbenzene	0.26	0.3	µg/L	7.14
			TO3	5 - 10	Petroleum Hydrocarbons	910	910	µg/L	0.00
			TO3	5 - 10	Xylenes (Total)	1	1.2	µg/L	9.09
MW2-OT45	18-Oct-94	Soil Gas Flux	TO3	0 - 0	Benzene	0.007 U	0.007 U	µg/L	
			TO3	0 - 0	Toluene	0.023	0.015	µg/L	21.05
			TO3	0 - 0	Ethylbenzene	0.009 U	0.009 U	µg/L	
			TO3	0 - 0	Petroleum Hydrocarbons	3.1	2.5	µg/L	10.71
			TO3	0 - 0	Xylenes (Total)	0.009 U	0.009 U	µg/L	
MW10-OT45	03-Oct-94	Soil	SW8020	9 - 11	Benzene	0.46 U	0.4 U	µg/kg	
			SW8020	9 - 11	Toluene	4.6 U	4 U	µg/kg	
			SW8020	9 - 11	Ethylbenzene	4.6 U	4 U	µg/kg	
			SW8020	9 - 11	1,2,3-Trimethylbenzene	4.6 U	4 U	µg/kg	
			SW8020	9 - 11	1,2,4-Trimethylbenzene	4.6 U	4 U	µg/kg	
			SW8020	9 - 11	1,3,5-Trimethylbenzene	4.6 U	4 U	µg/kg	
			SW8020	9 - 11	Xylenes (Total)	4.6 U	4 U	µg/kg	
			SW8270	9 - 11	Acenaphthene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Acenaphthylene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Anthracene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Benzo(a)anthracene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Benzo(a)pyrene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Benzo(b)fluoranthene	380 U	350 U	µg/kg	

TABLE B.12  
DUPLICATE AND REPLICATE SAMPLE RESULTS  
REMEDIAL ACTION PLAN  
RISK-BASED APPROACH TO REMEDIATION  
SITE OT45, WURTSMITH AFB, MICHIGAN

Sample Location	Sample Date	Matrix	Analytical Method	Sample Interval (ft bgs: beginning-ending)	Analyte	Real Sample Result	Duplicate Sample Result	Units	RPD <sup>a/</sup>
MW10-OT45	03-Oct-94	Soil	SW8270	9 - 11	Benzo(g,h,i)perylene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Benzo(k)fluoranthene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Chrysene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Dibenz(a,h)anthracene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Dibenzofuran	380 U	350 U	µg/kg	
			SW8270	9 - 11	Fluorene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Fluoranthene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Indeno(1,2,3-cd)pyrene	380 U	350 U	µg/kg	
			SW8270	9 - 11	2-Methylnaphthalene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Naphthalene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Phenanthrene	380 U	350 U	µg/kg	
			SW8270	9 - 11	Pyrene	380 U	350 U	µg/kg	

<sup>a/</sup> RPD = relative percent difference between real and duplicate sample.

**TABLE B.13**  
**DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC**  
**COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES**  
**(1995 DETECTED ANALYTES ONLY)**  
**REMEDIATION ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
OT45-MW11	17-Oct-95	Benzene	1.3	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	2.9	µg/L	SW8020
OT45-MW11	17-Oct-95	Benzene	1.1	µg/L	SW8260
		1,2,3,4-Tetramethylbenzene	4.3	µg/L	SW8260
OT45-MW11	17-Oct-95	Naphthalene	1	µg/L	SW8270
OT45-MW5	17-Oct-95	Ethyl Benzene	5.0	µg/L	SW8020
		Total Xylenes (m,p & o)	11	µg/L	SW8020
		1,3,5-Trimethylbenzene	4.3	µg/L	SW8020
		1,2,4-Trimethylbenzene	15	µg/L	SW8020
		1,2,3-Trimethylbenzene	7.3	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	13	µg/L	SW8020
OT45-MW7	17-Oct-95	Benzene	1.3	µg/L	SW8020
		Ethyl Benzene	11	µg/L	SW8020
		Total Xylenes (m,p & o)	1.2	µg/L	SW8020
		1,3,5-Trimethylbenzene	5.4	µg/L	SW8020
		1,2,4-Trimethylbenzene	1.8	µg/L	SW8020
		1,2,3-Trimethylbenzene	1.8	µg/L	SW8020
OT45-MW12	17-Oct-95	1,2,3,4-Tetramethylbenzene	26	µg/L	SW8020
		Ethyl Benzene	2.8	µg/L	SW8020
		Total Xylenes (m,p & o)	5.4	µg/L	SW8020
		1,3,5-Trimethylbenzene	2.3	µg/L	SW8020
		1,2,4-Trimethylbenzene	7.6	µg/L	SW8020
		1,2,3-Trimethylbenzene	4.4	µg/L	SW8020
OT45-MW12	17-Oct-95	1,2,3,4-Tetramethylbenzene	7.4	µg/L	SW8020
		Naphthalene	18	µg/L	SW8270
OT45-MW4	17-Oct-95	1,2,3-Trimethylbenzene	0.8	µg/L	SW8020
OT45-MW10	18-Oct-95	Total Xylenes (m,p & o)	1.3	µg/L	SW8020
OT45-MPB	18-Oct-95	Ethyl Benzene	0.6	µg/L	SW8020
		Total Xylenes (m,p & o)	2.6	µg/L	SW8020
		1,2,4-Trimethylbenzene	1.5	µg/L	SW8020
		1,2,3-Trimethylbenzene	1.3	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	2.1	µg/L	SW8020
OT45-VW1	18-Oct-95	Ethyl Benzene	0.8	µg/L	SW8020
		Total Xylenes (m,p & o)	3.2	µg/L	SW8020
		1,3,5-Trimethylbenzene	2.4	µg/L	SW8020
		1,2,4-Trimethylbenzene	6.4	µg/L	SW8020
		1,2,3-Trimethylbenzene	2.3	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	9.4	µg/L	SW8020

**TABLE B.13 (Continued)**  
**DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC**  
**COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES**  
**(1995 DETECTED ANALYTES ONLY)**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
OT45-MW2	18-Oct-95	Toluene	1.8	µg/L	SW8020
		Ethyl Benzene	10	µg/L	SW8020
		Total Xylenes (m,p & o)	21	µg/L	SW8020
		1,3,5-Trimethylbenzene	8.7	µg/L	SW8020
		1,2,4-Trimethylbenzene	48	µg/L	SW8020
		1,2,3-Trimethylbenzene	26	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	66	µg/L	SW8020
OT45-BP4	18-Oct-95	Toluene	1.9	µg/L	SW8020
		Ethyl Benzene	0.6	µg/L	SW8020
		Total Xylenes (m,p & o)	2.1	µg/L	SW8020
OT45-BP1	18-Oct-95	Toluene	3.9	µg/L	SW8020
		Total Xylenes (m,p & o)	1.2	µg/L	SW8020
		1,2,3,4-Tetramethylbenzene	1.2	µg/L	SW8020
OT45-BP2	18-Oct-95	Benzene	0.5	µg/L	SW8020
		Toluene	4.2	µg/L	SW8020
OT45-BP3	18-Oct-95	Toluene	6.7	µg/L	SW8020
		Ethyl Benzene	1.5	µg/L	SW8020
		Total Xylenes (m,p & o)	9.8	µg/L	SW8020
		1,3,5-Trimethylbenzene	0.7	µg/L	SW8020
		1,2,4-Trimethylbenzene	1.7	µg/L	SW8020
OT45-VW1	18-Oct-95	Naphthalene	22	µg/L	SW8270
OT45-MW2	18-Oct-95	Naphthalene	130	µg/L	SW8270
		Phenanthrene	6	µg/L	SW8270
OT45-MW5	17-Oct-95	Naphthalene	11	µg/L	SW8270



**TABLE B.14**  
**DETECTED ANALYTES IN GROUNDWATER FOR VOLATILE ORGANIC**  
**COMPOUND AND SEMIVOLATILE COMPOUND ANALYSES**  
**(1996 - 1997 DETECTED ANALYTES ONLY)**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
OT45-MW7	6-Nov-96	Trichloroethene	3J	µg/L	SW8260
		Ethyl Benzene	7	µg/L	SW8260
		Total Xylenes (m,p & o)	2J	µg/L	SW8260
		1,3,5-Trimethylbenzene	6	µg/L	SW8260
		1,2,4-Trimethylbenzene	1J	µg/L	SW8260
		1,2,3-Trimethylbenzene	1J	µg/L	SW8260
OT45-MW2	24-Jun-97	1,2,3,4-Tetramethylbenzene	7.4	µg/L	SW8260?

J = indicates a laboratory estimated value; compound was detected, but below the laboratory reporting limit or estimated quantitation limit.

TABLE B.14a

**POSITIVE DETECTIONS OF TARGET ANALYTES IN 1997 GROUNDWATER SAMPLES  
RCRA CLOSURE OF DRMO FACILITY  
WURTSMITH AFB, OSCODA, MICHIGAN**

SAMPLE LOCATION	DATE SAMPLED	ANALYTE (ug/l)						
		ETHYLBENZENE	NAPHTHALENE	n-PROPYLBENZENE	TRICHLOROETHENE	1,2,4-TRIMETHYLBENZENE	1,3,5-TRIMETHYLBENZENE	m,p-XYLENE
ACTION LEVEL (307) <sup>1</sup>	--	74	250	2	2.2	38	23	280
ACTION LEVEL (201 Res.) <sup>2</sup>	--	74	280	2	5	38	23	280
ACTION LEVEL (201 Ind.) <sup>3</sup>	--	74	750	2	5	66	65	280
MW02	11/5/97	4	98	2	2	41	4	6
MW11	11/5/97	<1	5	<1	8	<1	<1	<2
TW01	11/5/97	<1	<5	<1	<1	<1	<1	<2
TW04	11/5/97	<1	<5	<1	1	<1	<1	<2
TW11	11/5/97	<1	<5	<1	1	<1	<1	<2
TW11-DUP	11/5/97	<1	<5	<1	<1	<1	<1	<2
TW12	11/5/97	<1	<5	<1	<1	<1	<1	<2
TRIP BLANK	11/5/97	<1	<5	<1	<1	<1	<1	<2
RINSATE BLANK	11/5/97	<1	<5	<1	<1	<1	<1	<2
FIELD BLANK	11/5/97	<1	<5	<1	<1	<1	<1	<2

**NOTES:**

< - Analyte Not Detected at Reported Quantitation Limit.

DUP - Duplicate Sample.

1 - Action Level Selected From MERA Operational Memorandum #8, Revision 3 (February 4, 1994).

2 - Action Level Selected From Interim Environmental Response Division Operational Memorandum #8, Revision 4 (June 5, 1995).

**TABLE B.15**  
**QA/QC WATER BLANKS**  
**(1996 - 1997)**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Type/Analyte	Result	Units	Analytical Method
OT45-MW7	6-Nov-96	Equipment Blank			
		Trichloroethene	U	µg/L	SW8260
		Ethyl Benzene	U	µg/L	SW8260
		Total Xylenes (m,p & o)	U	µg/L	SW8260
		1,3,5-Trimethylbenzene	U	µg/L	SW8260
		1,2,4-Trimethylbenzene	U	µg/L	SW8260
		1,2,3-Trimethylbenzene	U	µg/L	SW8260
OT45-MW7	6-Nov-96	Trip Blank			
		Trichloroethene	U	µg/L	SW8260
		Ethyl Benzene	U	µg/L	SW8260
		Total Xylenes (m,p & o)	U	µg/L	SW8260
		1,3,5-Trimethylbenzene	U	µg/L	SW8260
		1,2,4-Trimethylbenzene	U	µg/L	SW8260
		1,2,3-Trimethylbenzene	U	µg/L	SW8260
OT45-MW7	6-Nov-96	Matrix Spike			
		Trichloroethene	22	µg/L	SW8260
		Ethyl Benzene	28	µg/L	SW8260
		Total Xylenes (m,p & o)	21	µg/L	SW8260
		1,3,5-Trimethylbenzene	-- <sup>1</sup>	µg/L	SW8260
		1,2,4-Trimethylbenzene	-- <sup>1</sup>	µg/L	SW8260
		1,2,3-Trimethylbenzene	-- <sup>1</sup>	µg/L	SW8260
OT45-MW2	6-Nov-96	Matrix Spike Duplicate			
		Trichloroethene	18	µg/L	SW8260
		Ethyl Benzene	20	µg/L	SW8260
		Total Xylenes (m,p & o)	20	µg/L	SW8260
		1,3,5-Trimethylbenzene	20	µg/L	SW8260
		1,2,4-Trimethylbenzene	20	µg/L	SW8260
		1,2,3-Trimethylbenzene	19	µg/L	SW8260
OT45-EB10	24-Jun-97	Equipment Blank			
		1,2,3,4-Tetramethylbenzene	U	µg/L	SW8260
OT45	24-Jun-97	Trip Blank			
		1,2,3,4-Tetramethylbenzene	U	µg/L	SW8260
OT45-VW1 <sup>2</sup>	24-Jun-97	Matrix Spike Duplicate			
		1,2,3,4-Tetramethylbenzene	20	µg/L	SW8260

U = compound analyzed for, but not detected above reporting limits. Reporting limits are roughly the method detection limits for reagent water.

<sup>1</sup>-- matrix spike analyses were not performed for the methylbenzenes using OT45-MW7 sample data.

<sup>2</sup>-- no matrix spike analyses was performed using MW2 sample information.

**TABLE B.16**  
**DETECTED ANALYTES IN SOIL FOR VOLATILE ORGANIC COMPOUND**  
**AND SEMIVOLATILE COMPOUND ANALYSES**  
**(1996 DETECTED ANALYTES ONLY)**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Analyte	Result	Units	Analytical Method
C1	27-Jul-96	Toluene	0.9J	µg/kg	SW8020
		Total Xylenes (m,p & o)	1J	µg/kg	SW8020
C2	27-Jul-96	1,2,3,4-Tetramethylbenzene	0.7J	µg/kg	SW8020
C3	27-Jul-96	Toluene	0.8J	µg/kg	SW8020
		Total Xylenes (m, p & o)	0.7J	µg/kg	SW8020
		Pyrene	58J	µg/kg	SW8270
C4	28-Jul-96	Pyrene	34J	µg/kg	SW8270
C7	28-Jul-96	Ethylbenzene	0.6J	µg/kg	SW8020
		Total Xylenes (m, p & o)	2.3J	µg/kg	SW8020
		1,2,3-Trimethylbenzene	1.3J	µg/kg	SW8020
		1,2,4-Trimethylbenzene	2.7J	µg/kg	SW8020
		1,3,5-Trimethylbenzene	2.3J	µg/kg	SW8020
		1,2,3,4-Tetramethylbenzene	30	µg/kg	SW8020
		2-Methylnaphthalene	47J	µg/kg	SW8270
		Naphthalene	35J	µg/kg	SW8270
		Phenanthrene	21J	µg/kg	SW8270
C8	28-Jul-96	Pyrene	58J	µg/kg	SW8270
		1,3,5-Trimethylbenzene	0.7J	µg/kg	SW8020
C10	28-Jul-96	2-Methylnaphthalene	110J	µg/kg	SW8270
		Total Xylenes (m, p & o)	0.6J	µg/kg	SW8020
C13	4-Aug-96	1,3,5-Trimethylbenzene	0.5J	µg/kg	SW8020
		Total Xylenes (m, p & o)	0.6J	µg/kg	SW8020
C14	4-Aug-96	1,3,5-Trimethylbenzene	0.5J	µg/kg	SW8020
		Total Xylenes (m, p & o)	0.5J	µg/kg	SW8020
C14	4-Aug-96	1,2,3,4-Tetramethylbenzene	1.0J	µg/kg	SW8020
		Total Xylenes (m, p & o)	0.5J	µg/kg	SW8020

J = indicates a laboratory estimated value; compound was detected, but below the laboratory reporting limit or estimated quantitation limit.

**TABLE B.17**  
**QA/QC SOIL BLANKS**  
**(1996)**  
**REMEDIAL ACTION PLAN**  
**RISK-BASED APPROACH TO REMEDIATION**  
**SITE OT-45, WURTSMITH AFB, MICHIGAN**

Sample Location	Sample Date	Sample Type/Analyte	Result	Units	Matrix
OT45-R1	4-Aug-96	Replicate			Water
		Benzene	U	µg/L	
		Ethyl Benzene	U	µg/L	
		Toluene	U	µg/L	
		Total Xylenes (m,p & o)	U	µg/L	
		Chlorobenzene	U	µg/L	
		1,3,5-Trimethylbenzene	U	µg/L	
		1,2,4-Trimethylbenzene	U	µg/L	
		1,2,3-Trimethylbenzene	U	µg/L	
		1,2,3,4-Tetramethylbenzene	0.6	µg/L	
OT45-R2	4-Aug-96	Replicate			Water
		Benzene	U	µg/L	
		Ethyl Benzene	U	µg/L	
		Toluene	U	µg/L	
		Total Xylenes (m,p & o)	U	µg/L	
		Chlorobenzene	U	µg/L	
		1,3,5-Trimethylbenzene	U	µg/L	
		1,2,4-Trimethylbenzene	U	µg/L	
		1,2,3-Trimethylbenzene	U	µg/L	
		1,2,3,4-Tetramethylbenzene	U	µg/L	
OT45-TB	4-Aug-96	Trip Blank			Water
		Benzene	U	µg/L	
		Ethyl Benzene	U	µg/L	
		Toluene	U	µg/L	
		Total Xylenes (m,p & o)	U	µg/L	
		Chlorobenzene	U	µg/L	
		1,3,5-Trimethylbenzene	U	µg/L	
		1,2,4-Trimethylbenzene	U	µg/L	
		1,2,3-Trimethylbenzene	U	µg/L	
		1,2,3,4-Tetramethylbenzene	U	µg/L	
OT45-FB	4-Aug-96	Field Blank			Water
		Benzene	U	µg/L	
		Ethyl Benzene	U	µg/L	
		Toluene	U	µg/L	
		Total Xylenes (m,p & o)	U	µg/L	
		Chlorobenzene	U	µg/L	
		1,3,5-Trimethylbenzene	U	µg/L	
		1,2,4-Trimethylbenzene	U	µg/L	
		1,2,3-Trimethylbenzene	U	µg/L	
		1,2,3,4-Tetramethylbenzene	U	µg/L	
OT45-W1	4-Aug-96	Water Blank			Water
		Benzene	U	µg/L	
		Ethyl Benzene	U	µg/L	
		Toluene	U	µg/L	
		Total Xylenes (m,p & o)	U	µg/L	
		Chlorobenzene	U	µg/L	
		1,3,5-Trimethylbenzene	U	µg/L	
		1,2,4-Trimethylbenzene	U	µg/L	
		1,2,3-Trimethylbenzene	U	µg/L	
		1,2,3,4-Tetramethylbenzene	U	µg/L	

U = compound analyzed for, but not detected above reporting limits. Reporting limits are roughly the method detection limits for reagent water.

EVERGREEN ANALYTICAL, INC.  
4036 Youngfield St. Wheat Ridge, CO 80033  
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Method 602 Data Report

Client Sample Number	: MW-11	Client Project No.	: 725520.500 Wurtsmith
Lab Sample Number	: X05424	Lab Project No.	: 95-1136
Date Sampled	: 4/6/95	Dilution Factor	: 1.00
Date Received	: 4/7/95	Method	: 602
Date Prepared	: 4/12/95	Matrix	: Water
Date Analyzed	: 4/12/95	Lab File No.	: BX2041210
		Method Blank No.	: MB041295

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	0.9	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	4.7	0.4
Surrogate Recovery ( $\alpha,\alpha,\alpha$ -Trifluorotoluene):		91%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.  
The Xylene RL is for a single peak.

QUALIFIERS:

E = Extrapolated value.

U = Compound analyzed for, but not detected.

B = Compound also found in the blank.

RL = Reporting Limit.

NA = Not Available/Not Applicable.

  
Analyst

  
Approved

**1994 VALIDATION RESULTS**

**MS/MSD SAMPLES &  
GC/MS CONFIRMATION SAMPLES**

GCMS CONFIRMATION

Client Sample Number	: MW-11	Client I.D.	: 725520.500/
Lab Sample Number	: X05424		WURTSMITH
Date Sampled	: 04/06/95	Lab Project No.	: 95-1136
Date Received	: 04/07/95	Effective Dilution	: 1.00
Date Extracted/Prepared	: 04/10/95	Method	: 8240(8260)
Date Analyzed	: 04/10/95	Matrix	: WATER
Methanol Extract?	: N	Lab File No.	: >V6324
Percent Loss on Drying	: NA	Method Blank No.	: RB041095

Compound Name	Cas Number	Conc. ug/L	PQL* ug/L
Benzene	71-43-2	U	5
Toluene	108-88-3	U	5
Ethyl Benzene	100-41-4	U	5
Total Xylenes	1330-20-7	U	5
Chlorobenzene	108-90-7	U	5
1,2,4-Trimethylbenzene	95-63-6	U	10
1,2,3-Trimethylbenzene	526-73-8	U	10
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	U	10
1,2,3,4-Tetramethylbenzene	488-23-3	3	10
Styrene	100-42-5	U	5

Surrogate Recoveries:

QC Limits

1,2 Dichloroethane-d4	101%	(83-112)
Toluene-d8	101%	(93-104)
Bromofluorobenzene	103%	(87-105)

Qualifiers:

U = Compound analyzed for, but not detected above the reporting limit(0.2 ppb)  
R = Reporting limits are roughly the method detection limits in reagent water.  
E = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).  
B = Compound found in blank and sample. Compare blank and sample data.  
O = Compound is detected at a concentration outside the calibration limits.  
P = Practical Quantitation Limits listed are approximately 10 times the detection limits for reagent water.  
Unless otherwise noted all concentrations and PQL's for soils are quantitated on an as is basis.  
A = Not applicable or not available

Analyst

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(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: W407-SS51S	Client Project No.	: 725524.03000
Lab Sample No.	: X95774		Wurtsmith AFB
Date Sampled	: 10/3/94	Lab Project No.	: 94-3825
Date Received	: 10/6/94	EPA Method No.	: 8020
Date Prepared	: 10/17/94	Matrix	: Water
Date Analyzed	: 10/18/94	Lab File Number(s)	: BX2101723,24
		Method Blank	: MB101794

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	16.3	81.5	65-121
Toluene	20	0.8	15.1	71.5	69-117
Ethyl Benzene	20	0	14.6	73	68-118
m/p-Xylene	20	1.3	15.1	69	66-116
o-Xylene	20	0.5	15.1	73	73-117
1,3,5-TMB	20	0	14.5	72.5	65-121
1,2,4-TMB	20	0	14.9	74.5	65-121
1,2,3-TMB	20	0	15.5	77.5	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MS %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	19.4	97	17.4	17.4	65-121
Toluene	20	18.6	89	21.8 *	15.8	69-117
Ethyl Benzene	20	18.2	91	22.0 *	11.9	68-118
m/p-Xylene	20	19.1	89	25.3 *	15.4	66-116
o-Xylene	20	18.4	89.5	20.3 *	15.9	73-117
1,3,5-TMB	20	17.9	89.5	21.0 *	17.4	65-121
1,2,4-TMB	20	17.9	89.5	18.3 *	17.4	65-121
1,2,3-TMB	20	19.1	95.5	20.8 *	17.4	65-121

\* = Values outside of QC limits.

RPD: 7 out of (8) outside limits.

Spike Recovery: 0 out of (16) outside limits.

Comments: CJC

MS surrogate recovery: 81%. MSD surrogate recovery: 97%.

## SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.  
 Lab Project No.: 94-3825  
 Lab Sample No.: X95774  
 Lab File Ids.: >26914,5

Client I.D.: 725524.03000-  
 WURTSMITH AFB  
 Client Sample No.: W407-SS51S  
 Date Extracted: 10/13/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Phenol	200	0.00	166.99	83	26-90
2-Chlorophenol	200	0.00	145.49	73	25-102
1,4-Dichlorobenzene	100	0.00	70.17	70	28-104
N-Nitrosodipropylamine	100	0.00	89.58	90	41-126
1,2,4-Trichlorobenzene	100	0.00	62.01	62	38-107
4-Chloro-3-methylphenol	200	0.00	149.32	75	26-103
Acenaphthene	100	0.00	74.64	75	31-137
4-Nitrophenol	200	0.00	175.70	88	11-114
2,4-Dinitrotoluene	100	0.00	74.61	75	28-89
Pentachlorophenol	200	0.00	166.96	83	17-109
Pyrene	100	0.00	80.91	81	35-142

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Phenol	200	179.46	90	7.2	35	26-90
2-Chlorophenol	200	156.84	78	7.5	50	25-102
1,4-Dichlorobenzene	100	76.62	77	8.8	27	28-104
N-Nitrosodipropylamine	100	96.76	97	7.7	38	41-126
1,2,4-Trichlorobenzene	100	67.27	67	8.1	23	38-107
4-Chloro-3-methylphenol	200	159.29	80	6.5	33	26-103
Acenaphthene	100	80.11	80	7.1	19	31-137
4-Nitrophenol	200	155.41	78	12	50	11-114
2,4-Dinitrotoluene	100	79.32	79	6.1	47	28-89
Pentachlorophenol	200	166.05	83	0.55	47	17-109
Pyrene	100	89.80	90	10	36	35-142

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 11 outside limits.

Spike Recovery: 0 out of 22 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
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BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MPA-OT45S	Client Project No.	: 725523.03000
Lab Sample No.	: X95429	Lab Project No.	: 94-3750
Date Sampled	: 9/28/94	EPA Method No.	: 8020
Date Received	: 9/30/94	Matrix	: Water
Date Prepared	: 10/9/94	Lab File Number(s)	: BX2100921,22
Date Analyzed	: 10/10/94	Method Blank	: MB100994

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	17.1	85.5	65-121
Toluene	20	0.4	12.2	59*	69-117
Ethyl Benzene	20	0	15.9	79.5	68-118
m/p-Xylene	20	0	15.3	76.5	66-116
o-Xylene	20	0	16	80	73-117
1,3,5-TMB	20	0	15.7	78.5	65-121
1,2,4-TMB	20	0	14.6	73	65-121
1,2,3-TMB	20	0	15.7	78.5	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	16.9	84.5	1.2	17.4	65-121
Toluene	20	12.8	62*	5.0	15.8	69-117
Ethyl Benzene	20	15.9	79.5	0.0	11.9	68-118
m/p-Xylene	20	15.2	76	0.7	15.4	66-116
o-Xylene	20	15.7	78.5	1.9	13.2	73-117
1,3,5-TMB	20	15.1	75.5	3.9	17.4	65-121
1,2,4-TMB	20	14.0	70	4.2	17.4	65-121
1,2,3-TMB	20	14.8	74	5.9	17.4	65-121

\*= Values outside of QC limits.

RPD: 0 out of (8) outside limits.

Spike Recovery: 2 out of (16) outside limits.

Comments: CJC

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW-7OT45W	Client Project No.	: 725523.03000
Lab Sample No.	: X95433	Lab Project No.	: 94-3750
Date Sampled	: 9/28/94	EPA Method No.	: 8020
Date Received	: 9/30/94	Matrix	: Water
Date Prepared	: 10/1/94	Lab File Number(s)	: BX1093026,27
Date Analyzed	: 10/1/94	Method Blank	: MB093094

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	1.7	15.2	67.5	65-121
Toluene	20	0.4	14.3	69.5	69-117
Ethyl Benzene	20	1	14.9	69.5	68-118
m/p-Xylene	20	0.6	14.6	70	66-116
o-Xylene	20	0	14.6	73	73-117

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	17.7	80	16.9 *	17.4	65-121
Toluene	20	16.7	81.5	15.9	15.8	69-117
Ethyl Benzene	20	17.3	81.5	15.9	11.9	68-118
m/p-Xylene	20	16.7	80.5	14.0 *	15.4	66-116
o-Xylene	20	16.6	83	12.8 *	13.2	73-117

\*= Values outside of QC limits.

RPD: 3 out of (5) outside limits.

Spike Recovery: 0 out of (10) outside limits.

Comments: CJC Surrogate recoveries: MS=67%, MSD=81%.  
All Spike recoveries are acceptable. Poor purge cycle during analysis of MS caused poor surrogate and unacceptable RPD results. No rerun was performed.

## SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3750

Lab Sample No. : X95429

Lab File Ids. : &gt;26787,26802

Client I.D. : 725523.03000

Client Sample No. : MPA-OT45S

Date Extracted : 10/04/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	0.00	67.50	68	NA
1,4-Dichlorobenzene	100	0.00	63.49	63	28-104
N-Nitrosodipropylamine	100	0.00	75.15	75	41-126
1,2,4-Trichlorobenzene	100	0.00	58.09	58	38-107

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Naphthalene	100	74.16	74	9.4	NA	NA
1,4-Dichlorobenzene	100	71.75	72	12	27	28-104
N-Nitrosodipropylamine	100	83.56	84	11	38	41-126
1,2,4-Trichlorobenzene	100	65.23	65	12	23	38-107

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3750

Lab Sample No. : X95433

Lab File Ids. : &gt;26779,80

Client I.D. : 725523.03000

Client Sample No. : MW7-OT45S

Date Extracted : 09/30/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	64.42	140.85	76	NA
1,4-Dichlorobenzene	100	0.00	82.39	82	36-97
N-Nitrosodipropylamine	100	0.00	100.13	100	41-116
1,2,4-Trichlorobenzene	100	0.00	76.17	76	39-98

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS	
					RPD	%REC
Naphthalene	100	147.74	83	8.6	NA	NA
1,4-Dichlorobenzene	100	87.46	87	6	28	36-97
N-Nitrosodipropylamine	100	102.98	103	2.8	38	41-116
1,2,4-Trichlorobenzene	100	79.81	80	4.7	28	39-98

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW9-OT45W	Client Project No.	: 725524.03000
Lab Sample No.	: X96712		Wurtsmith AFB
Date Sampled	: 10/12/94	Lab Project No.	: 94-3984
Date Received	: 10/15/94	EPA Method No.	: 602
Date Prepared	: 10/22/94	Matrix	: Water
Date Analyzed	: 10/23/94	Lab File Number(s)	: BX2102219,20
		Method Blank	: MB102294

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	19.8	99	65-121
Toluene	20	0	21.1	105.5	69-117
Ethyl Benzene	20	0	20.2	101	68-118
m/p-Xylene	20	0	20.6	103	66-116
o-Xylene	20	0	19.4	97	73-117
Chlorobenzene	20	0	19.3	96.5	65-121
1,3,5-TMB	20	0	19.3	96.5	65-121
1,2,4-TMB	20	0	18.8	94	65-121
1,2,3-TMB	20	0	23.1	115.5	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MS %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	17.5	87.5	12.3	17.4	65-121
Toluene	20	19	95	10.5	15.8	69-117
Ethyl Benzene	20	18	90	11.5	11.9	68-118
m/p-Xylene	20	18.5	92.5	10.7	15.4	66-116
o-Xylene	20	17.5	87.5	10.3	13.2	73-117
Chlorobenzene	20	17.4	87	10.4	17.4	65-121
1,3,5-TMB	20	17.7	88.5	8.6	17.4	65-121
1,2,4-TMB	20	17.1	85.5	9.5	17.4	65-121
1,2,3-TMB	20	20.5	102.5	11.9	17.4	65-121

\* = Values outside of QC limits.

RPD: 0 out of (9) outside limits.

Spike Recovery: 0 out of (18) outside limits.

Comments: CJC

## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.  
 Lab Project No.: 94-3984  
 Lab Sample No. : X96709  
 Lab File Ids. : >26978,9

Client I.D. : 725524.03000-  
 WURTSMITH AFB  
 Client Sample No. : MW1-OT45W  
 Date Extracted : 10/19/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	0.00	93.02	93	NA
1,4-Dichlorobenzene	100	0.00	72.97	73	36-97
N-Nitrosodipropylamine	100	0.00	110.71	111	41-116
1,2,4-Trichlorobenzene	100	0.00	61.74	62	39-98
Acenaphthene	100	0.00	81.66	82	46-118
2,4-Dinitrotoluene	100	0.00	80.11	80	24-96
Pyrene	100	0.00	90.97	91	26-127

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Naphthalene	100	82.46	82	12	NA	NA
1,4-Dichlorobenzene	100	62.33	62	16	28	36-97
N-Nitrosodipropylamine	100	101.12	101	9.1	38	41-116
1,2,4-Trichlorobenzene	100	53.07	53	15	28	39-98
Acenaphthene	100	71.84	72	13	31	46-118
2,4-Dinitrotoluene	100	72.23	72	10	38	24-96
Pyrene	100	76.70	77	17	31	26-127

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 7 outside limits.

Spike Recovery: 0 out of 14 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.



## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.  
 Lab Project No.: 94-3930  
 Lab Sample No. : X96364  
 Lab File Ids. : >26953,4

Client I.D. : 725523.03000-  
 WURTSMITH AFB  
 Client Sample No. : MW5-OT45W  
 Date Extracted : 10/13/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	31.98	112.90	81	NA
1,4-Dichlorobenzene	100	0.00	80.28	80	36-97
N-Nitrosodipropylamine	100	0.00	105.28	105	41-116
1,2,4-Trichlorobenzene	100	0.00	69.51	70	39-98
Acenaphthene	100	1.24	87.10	86	46-118
2,4-Dinitrotoluene	100	0.00	66.52	67	24-96
Pyrene	100	0.00	87.83	88	26-127

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Naphthalene	100	108.91	77	5.1	NA	NA
1,4-Dichlorobenzene	100	79.77	80	0.64	28	36-97
N-Nitrosodipropylamine	100	103.75	104	1.5	38	41-116
1,2,4-Trichlorobenzene	100	67.88	68	2.4	28	39-98
Acenaphthene	100	83.75	84	2.5	31	46-118
2,4-Dinitrotoluene	100	62.03	62	7	38	24-96
Pyrene	100	87.38	86	1.9	31	26-127

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 7 outside limits.

Spike Recovery: 0 out of 14 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW4-OT45S	Client Project No.	: 725523.03000
Lab Sample No.	: X95488	Lab Project No.	: 94-3764
Date Sampled	: 9/29/94	EPA Method No.	: 8020
Date Received	: 10/1/94	Matrix	: Soil
Date Prepared	: 10/10/94	Lab File Number(s)	: BX2101020
Date Analyzed	: 10/11/94	Method Blank	: MB101094

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	12.7	63.5*	65-121
Toluene	20	0	12.1	60.5*	69-117
Ethyl Benzene	20	0	10.4	52*	68-118
m/p-Xylene	20	0	9.4	47*	66-116
o-Xylene	20	0	10.6	53*	73-117
1,3,5-TMB	20	0	8.8	44*	65-121
1,2,4-TMB	20	0	8.7	43.5*	65-121
1,2,3-TMB	20	0	10.6	53*	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	NA	NA	NA	17.4	65-121
Toluene	20	NA	NA	NA	15.8	69-117
Ethyl Benzene	20	NA	NA	NA	11.9	68-118
m/p-Xylene	20	NA	NA	NA	15.4	66-116
o-Xylene	20	NA	NA	NA	13.2	73-117
1,3,5-TMB	20	NA	NA	NA	17.4	65-121
1,2,4-TMB	20	NA	NA	NA	17.4	65-121
1,2,3-TMB	20	NA	NA	NA	17.4	65-121

\* = Values outside of QC limits.

RPD: NA out of (8) outside limits.

Spike Recovery: 8 out of (16) outside limits.

Comments: CJC  
MS surrogate recovery: 58%. MSD did not purge on this run.  
MS & MSD analyzed 10/17/94.

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW4-OT45S	Client Project No.	: 725523.03000
Lab Sample No.	: X95488	Lab Project No.	: 94-3764
Date Sampled	: 9/29/94	EPA Method No.	: 8020
Date Received	: 10/1/94	Matrix	: Soil
Date Prepared	: 10/16/94	Lab File Number(s)	: BX2101620
Date Analyzed	: 10/17/94	Method Blank	: MB101694

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	15.4	77	65-121
Toluene	20	0	15.2	76	69-117
Ethyl Benzene	20	0	13.4	67*	68-118
m/p-Xylene	20	0	14.2	71	66-116
o-Xylene	20	0	12.3	61.5*	73-117
1,3,5-TMB	20	0	11.9	59.5*	65-121
1,2,4-TMB	20	0	9.8	49*	65-121
1,2,3-TMB	20	0	7.6	38*	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	NA	NA	NA	17.4	65-121
Toluene	20	NA	NA	NA	15.8	69-117
Ethyl Benzene	20	NA	NA	NA	11.9	68-118
m/p-Xylene	20	NA	NA	NA	15.4	66-116
o-Xylene	20	NA	NA	NA	13.2	73-117
1,3,5-TMB	20	NA	NA	NA	17.4	65-121
1,2,4-TMB	20	NA	NA	NA	17.4	65-121
1,2,3-TMB	20	NA	NA	NA	17.4	65-121

\* = Values outside of QC limits.

RPD: NA out of (8) outside limits.

Spike Recovery: 5 out of (16) outside limits.

Comments: CJC  
MS surrogate recovery: 78%. MSD did not purge on this run.

## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3764

Lab Sample No. : X95490

Lab File Ids. : &gt;26784,85

Client I.D. : 725523.03000

Client Sample No. : MW8-OT45W

Date Extracted : 10/01/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	0.00	84.12	84	NA
1,4-Dichlorobenzene	100	0.00	71.25	71	36-97
N-Nitrosodipropylamine	100	0.00	98.89	99	41-116
1,2,4-Trichlorobenzene	100	0.00	65.67	66	39-98

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Naphthalene	100	88.82	89	5.4	NA	NA
1,4-Dichlorobenzene	100	73.61	74	3.3	28	36-97
N-Nitrosodipropylamine	100	102.25	102	3.3	38	41-116
1,2,4-Trichlorobenzene	100	68.00	68	3.5	28	39-98

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 4 outside limits.

Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.  
 Lab Project No.: 94-3846  
 Lab Sample No.: X95861  
 Lab File Ids.: >26892,93

Client I.D.: 725524.03  
 Client Sample No.: MW10-OT45W  
 Date Extracted: 10/07/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Phenol	200	0.00	217.01	109 *	12-89
2-Chlorophenol	200	0.00	200.59	100	27-123
1,4-Dichlorobenzene	100	0.00	94.71	95	36-97
N-Nitrosodipropylamine	100	0.00	125.77	126 *	41-116
1,2,4-Trichlorobenzene	100	0.00	81.89	82	39-98
4-Chloro-3-methylphenol	200	0.00	197.60	99 *	23-97
Acenaphthene	100	0.00	99.28	99	46-118
4-Nitrophenol	200	0.00	224.50	112 *	10-80
2,4-Dinitrotoluene	100	0.00	100.19	100 *	24-96
Pentachlorophenol	200	0.00	241.67	121 *	9-103
Pyrene	100	0.00	78.97	79	26-127
NAPHTHALENE	100	0.00	106.14	106	NA

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Phenol	200	209.56	105 *	3.5	42	12-89
2-Chlorophenol	200	183.58	92	8.9	40	27-123
1,4-Dichlorobenzene	100	95.23	95	0.55	28	36-97
N-Nitrosodipropylamine	100	122.73	123 *	2.4	38	41-116
1,2,4-Trichlorobenzene	100	81.22	81	0.82	28	39-98
4-Chloro-3-methylphenol	200	194.80	97 *	1.4	42	23-97
Acenaphthene	100	97.34	97	2	31	46-118
4-Nitrophenol	200	80.64	40	94 *	50	10-80
2,4-Dinitrotoluene	100	94.95	95	5.4	38	24-96
Pentachlorophenol	200	111.75	56	74 *	50	9-103
Pyrene	100	79.58	80	0.77	31	26-127
NAPHTHALENE	100	100.75	101	5.2	NA	NA

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 2 out of 11 outside limits.

Spike Recovery: 9 out of 22 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

Evergreen Analytical, Inc.  
4036 Youngfield, Wheat Ridge, CO 80033  
(303) 425-6021

BTEX Water Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: W408-SS51 S	Client Project No.	: 725524.03000
Lab Sample No.	: X96963	Wurtsmith AFB	
Date Sampled	: 10/3/94	Lab Project No.	: 94-3869
Date Received	: 10/8/94	EPA Method No.	: 8020
Date Prepared	: 10/19/94	Matrix	: Water
Date Analyzed	: 10/20/94	Lab File Number(s)	: BX2101918,19
		Method Blank	: MB101994

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20	0	18.4	92	65-121
Toluene	20	0	17.3	86.5	69-117
Ethyl Benzene	20	0	16.9	84.5	68-118
m/p-Xylene	20	0	16.1	80.5	66-116
o-Xylene	20	0	16.7	83.5	73-117
1,3,5-TMB	20	0	18.2	91	65-121
1,2,4-TMB	20	0	16.5	82.5	65-121
1,2,3-TMB	20	0	19.6	98	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MS %REC	RPD	QC Limits	
					RPD	%REC
Benzene	20	17.8	89	3.3	17.4	65-121
Toluene	20	16.3	81.5	6.0	15.8	69-117
Ethyl Benzene	20	16.5	82.5	2.4	11.9	68-118
m/p-Xylene	20	15.2	76	5.8	15.4	66-116
o-Xylene	20	16.1	80.5	3.7	13.2	73-117
1,3,5-TMB	20	16.9	84.5	7.4	17.4	65-121
1,2,4-TMB	20	15.7	78.5	5.0	17.4	65-121
1,2,3-TMB	20	18.7	93.5	4.7	17.4	65-121

\* = Values outside of QC limits.

RPD: 0 out of (8) outside limits.

Spike Recovery: 0 out of (16) outside limits.

Comments: CJC

## WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: EVERGREEN ANALYTICAL INC.

Lab Project No.: 94-3869

Lab Sample No. : X95962

Lab File Ids. : &gt;26850,1

Client I.D. : 725524.03

Client Sample No. : W409M-SS51W

Date Extracted : 10/10/94

COMPOUND	SPIKE ADDED (mg/ml)	SAMPLE CONCENTRATION (mg/ml)	MS CONCENTRATION (mg/ml)	MS % REC #	QC LIMITS %REC
Naphthalene	100	0.00	89.95	90	NA
1,4-Dichlorobenzene	100	0.00	71.59	72	36-97
N-Nitrosodipropylamine	100	0.00	97.66	98	41-116
1,2,4-Trichlorobenzene	100	0.00	60.94	61	39-98

COMPOUND	SPIKE ADDED (mg/ml)	MSD CONCENTRATION (mg/ml)	MSD % REC #	RPD #	QC LIMITS RPD	%REC
Naphthalene	100	93.64	94	4	NA	NA
1,4-Dichlorobenzene	100	69.70	70	2.7	28	36-97
N-Nitrosodipropylamine	100	103.02	103	5.3	38	41-116
1,2,4-Trichlorobenzene	100	65.40	65	7.1	28	39-98

# Column to be used to flag recovery and RPD values with an asterisk

\* Values outside of QC limits

RPD: 0 out of 4 outside limits.Spike Recovery: 0 out of 8 outside limits.

Comments: Values are reported in mg/ml in the liquid concentrate.

**1992 RI ANALYTICAL RESULTS**



TABLE 4-11

SUMMARY OF SOIL ANALYSIS  
SITE 01-45  
DRAFT RI DELIVERY ORDER 10  
WURTSMITH AIR FORCE BASE

Sample #: S80T45143 S80T45052 S80T45055 S80T45056 S80T45059  
Sample Location: M2-OT45 S81-OT45 S82-OT45 S83-OT45  
Sample Depth (ft.): 9 - 11 11.5 - 13.5 10 - 12 10 - 12 (D) 10 - 12  
Sampling Date: 11/09/92 10/23/92 10/23/92 10/23/92 10/23/92

Parameter	Type A'	Type B'	Units		
Ethylbenzene	10	8E+06	µg/kg	42.00	2800.00 1900.00 4100.00
Fluoranthene	330	1E+07	µg/kg	12000.00	
Flourene	330	1E+07	µg/kg	220.00	1200.00 5100.00
Naphthalene	330	1E+07	µg/kg	18000.00	1600.00 15000.00
Phenanthrene	330	ID	µg/kg	500.00	3200.00 11000.00
Toluene	10	2E+07	µg/kg	260.00	180.00 210.00
Xylenes (total)	30	2E+08	µg/kg	65100	2600.00 1800.00 6000.00

D Duplicate

ID Insufficient Data

- (1) Michigan Act 307 levels - Background/Method Detection Limits  
(2) Michigan Act 307 Direct Contact Levels

TABLE 4-12

SUMMARY OF GROUNDWATER ANALYSIS  
 SITE OT-45  
 DRAFT RI DELIVERY ORDER 10  
 WORTHSMITH AIR FORCE BASE

Sample #: GWOT45135 GWOT45136 GWOT45140 GWOT45142 GWOT45V015  
 Sample Location: HW2-OT45 HW2-OT45 HW2-OT45 HW2-OT45 V-OT45  
 Sample Depth (Ft.): 9 - 12 19 - 22 52 - 55 58 - 61 13.4  
 Sampling Date: 11/09/92 11/09/92 11/09/92 11/09/92 10/23/92

Parameter	Type A <sup>1</sup>	Type B <sup>2</sup>	Units	Value
Benzene	1		µg/L	26.00
Ethylbenzene	1	700	µg/L	1.00
Fluorene	5	6000	µg/L	220.00
Naphthalene	5	600	µg/L	2200.00
Phenanthrene	5	330	µg/L	1500.00
Toluene	1	1000	µg/L	19.00
Xylenes (total)	3	10,000	µg/L	184.00
				3.20
				51.00

(1) Michigan Act 307 Levels - Background/Method Detection Limits

(2) Michigan Act 307 Direct Contact Levels